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SELECTED WATER RESOURCES ABSTRACTS

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 11, NUMBER 13
JULY 1, 1978

W78-05701 -- W78-06200

The Secretary of the U.S. Department of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1978.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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01 NATURE OF WATER
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02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

THE APPLICATION OF REMOTE SENSING TO THE DEVELOPMENT AND FORMULATION OF HYDROLOGIC PLANNING MODELS.
Ecosystems International, Inc., Gamborille, MD.
For primary bibliographic entry see Field 4D.
W78-05718

A STUDY OF APPLICATION OF REMOTE SENSING TO RIVER FORECASTING, VOLUME II.
IBM Federal Systems Div., Huntsville, AL.
For primary bibliographic entry see Field 4A.
W78-05719

THE ANATOMY OF THE MODELLING PROCESS,
Maryland Univ., College Park. Dept. of Civil Engineering.
R. H. McCuen.
In: Mathematical Models for Environmental Problems. Proceedings of the International Conference, University of Southampton, England, Sept. 8-12, 1975. C.A. Brebbia (Ed.), Southampton University. John Wiley & Sons, N.Y., N.Y., p 401-412, 1976. 2 fig.

Descriptors: *Mathematical models, *Systems analysis, *Sensitivity, *Decision making, Environmental control, Planning, Optimization, Equations.

The role of mathematical modeling in the systems approach to problem-solving is examined. Since most environmental problems are highly complex and require multi-purpose solutions, models are needed in order to consider the dynamic nature of such problems, as well as the risks involved. In addition to predicting the response of a system, a model can be used to evaluate the relative importance of subsystem and external factors that can influence the output. Model verification can identify deficiencies in both model structure and the information required to calibrate and use the model. Examined first are the classification of models and modeling as an element of the systems approach. Then the mathematical foundations of sensitivity, so important to the modeling process, are discussed in detail. Considered are: the sensitivity equation; computational methods; parametric and component sensitivity; absolute and relative sensitivity; sensitivity and correlation; and multiple-effect sensitivity. The paper concludes with a discussion of sensitivity in model formulation and verification. Modeling is both an art and a science, and as such is valuable in improving decision-making capabilities and thus system operation. The techniques presented herein provide a means of obtaining the maximum possible information from observed data, thus furnishing a basis for formulating a rational representation of the system. (See also W78-05720) (Bell-Cornell)
W78-05726

RANDOM SEARCH OPTIMIZATION: STOPPING RULES,
Aalborg Universitetscenter (Denmark).
P. Thoft-Christensen.
In: Mathematical Models for Environmental Problems. Proceedings of the International Conference, University of Southampton, England, Sept. 8-12, 1975. C.A. Brebbia (Ed.), Southampton University. John Wiley & Sons, N.Y., N.Y., p 413-421, 1976. 7 ref.

Descriptors: *Random search, *Optimization, *Stopping rules, Environmental engineering, Criterion function, Global optimum, Multimodal functions, Nonlinear programming, Mathematical models, Systems analysis, Equations, Algorithms.

Nonlinear optimization has become more usable for engineers and scientists. The stopping rule or termination criterion is of major importance for the effectiveness of an iterative method. For multimodal functions where more than one optimum point exists, a good choice of termination criterion is essential. Unimodal problems can be successfully handled in most cases with nonlinear optimization techniques. But serious problems exist in dealing with multimodal functions. This paper considers stopping rules with reference to a recently presented very simple optimization strategy based on random search; the discussion is limited to unconstrained parameter optimization. To help solve the problem of choosing relevant and effective stopping rules, it is important to secure more experimental experience. More theoretical investigations of the combination of probability distributions and stopping rules are needed. (See also W78-05720) (Bell-Cornell)
W78-05727

A GENERAL CLASS OF STOCHASTIC MODELS FOR HYDROLOGIC SEQUENCES,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
J. Ledolter.
Journal of Hydrology, Vol 36, No 3/4, p 309-325, February 1978. 3 fig, 3 tab, 16 ref, 1 append.

Descriptors: *Model studies, *Mathematical models, *Computer models, Hydrology, Stochastic processes, Markov processes, Time series analysis, Analytical techniques, Seasonal, Hydrologic data, Runoff, *Hydrologic sequences.

Stochastic models for hydrologic sequences were discussed. The class of autoregressive integrated moving average (ARIMA) models and the family of power transformations were introduced and illustrated on a set of streamflow data. ARIMA models and their seasonal extensions are a generalization of the Markovian models which are used frequently to describe the correlation structure of hydrologic sequences. The family of power transformations is a parametric class of transformations which includes the logarithmic transformation as a special case. (Sims-ISWS)
W78-05768

ANALYSIS OF HYDROLOGICAL RECESSION CURVES,
Commonwealth Scientific and Industrial Research Organization, Brisbane (Australia). Div. of Mathematics and Statistics.
For primary bibliographic entry see Field 2E.
W78-05769

A CRITERION OF EFFICIENCY FOR RAINFALL-RUNOFF MODELS,
University Coll., Galway (Ireland). Dept. of Engineering Hydrology.
M. Garrick, C. Cunnane, and J. E. Nash.
Journal of Hydrology, Vol 36, No 3/4, p 375-381, February 1978. 2 ref.

Descriptors: *Rainfall-runoff relationships, *Model studies, *Mathematical models, Evaluation, Precipitation(Atmospheric), Runoff, Rainfall, Streamflow, River forecasting, Rivers, Watersheds(Basins), Drainage, Flow, Hydrology.

Two criteria were proposed for expressing the efficiency of conceptual rainfall-discharge models. The first criterion assessed the model as a means of converting the input factors into discharge by comparison with a forecast based only on the seasonal regime of the river. The second criterion expressed the efficiency of the model under the assumption that it was to be used with an updating procedure to provide a forecast of discharge over a prescribed lead time. (Sims-ISWS)
W78-05770

EFFECT OF SOIL HEAT FLUX ON THE WATER BALANCE OF A SMALL CATCHMENT,
Waikato Univ., Hamilton (New Zealand). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2G.
W78-05777

CHARACTERISTICS OF THE INTERRELATION OF SURFACE AND GROUND WATERS IN THE KARAKENGIR RIVER BASIN WITH A DISTURBED NATURAL REGIME,
For primary bibliographic entry see Field 2F.
W78-05794

ESTIMATES OF LOW FLOWS USING WATERSHED AND CLIMATIC PARAMETERS,
Stephen F. Austin State Univ., Nacogdoches, TX. School of Forestry.
For primary bibliographic entry see Field 2E.
W78-05944

GENERATING RAINFALL EXCESS BASED ON READILY DETERMINABLE SOIL AND LANDUSE CHARACTERIST'CS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering.
E. A. Li, V. O. Shanholtz, D. N. Contractor, and J. C. Carr.
Transactions of the American Society of Agricultural Engineers, Vol. 20, No. 6, p 1070-1078, November-December 1977. 8 fig, 3 tab, 22 ref. OWRT A-077-VA(1).

Descriptors: *Model studies, *Watersheds(Basins), *Runoff, *Virginia, *Hydrology, Analytical techniques, Hydrographs, Land use, Discharge(Water), Simulation analysis, Soil moisture, Demonstration watersheds, Precipitation excess, Drainage, Soil types, Soils, *Brunswick County(Va), *Rocky Run Branch watershed(Va), Hydrologic response units, Hydrologic models.

A procedure was designed to isolate such factors as soil type, soil depth, slope, and landuse to define the effect of heterogeneity on surface runoff. The drainage area was subdivided into hydrologic response units based on these factors or combinations thereof. A soil moisture model was used to simulate rainfall excess on each partial area, and the excess was routed to the watershed outlet assuming the kinematic wave approximation and using the finite element numerical technique to solve the governing flow equations. Discharge data were not available for each definable response unit, and therefore direct experimental verification of the technique was not possible. Comparisons between the total simulated and recorded hydrograph were made in an ungaged context. These results indicated the potential application to ungaged or gaged areas. The routing routine did not allow for reinfiltration and so caused difficulties in modeling low rainfall-low runoff events. The best simulations, as expected, were with major flood events. (Humphreys-ISWS)
W78-05945

SOME REMARKS ON THE USE OF DAILY RAINFALL MODELS,
Agricultural Univ., Wageningen (Netherlands). Dept. of Land and Water Use; and Agricultural Univ., Wageningen (Netherlands). Dept. of Mathematics.
For primary bibliographic entry see Field 2B.
W78-06101

THE ANALYSIS OF MULTIVARIATE TIME SERIES APPLIED TO PROBLEMS IN HYDROLOGY,
International Inst. of Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 2E.
W78-06102

SOLUTE DISTRIBUTION PROFILES COMPUTED WITH STEADY-STATE AND TRANSIENT WATER MOVEMENT MODELS,
New Mexico State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W78-06110

STATISTICAL METHODS IN HYDROLOGY,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 7C.
W78-06125

A TWO DIMENSIONAL LAKE CIRCULATION MODEL USING THE METHODS OF FINITE ELEMENTS,
Massachusetts Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 2H.
W78-06200

2B. Precipitation

SPATIAL INTERPOLATION OF DAILY TOTALS OF RAINFALL,
Royal Netherlands Meteorological Inst., De Bilt.
S. Kruizinga, and G. J. Yperlaan.
Journal of Hydrology, Vol 36, No 1/2, p 65-73, January 1978. 5 fig, 1 tab, 4 ref.

Descriptors: *Rainfall, *Data collections, *Rain, Precipitation gages, Precipitation(Atmospheric), Meteorology, Meteorological data, Climatology, Foreign countries, Foreign research, *Daily rainfall, *Spatial interpolation, *The Netherlands, Interpolation techniques.

Some experiments concerning the spatial interpolation of daily totals of rainfall were reported. Several well-known techniques were evaluated in an experimental way, namely by using the given techniques for the estimation of the rainfall at a place where the rainfall also was measured. In each experiment, the same data set was used, so comparison of the performance of the different techniques was quite simple. The used techniques were all of the type of weighted average of surrounding stations (which type included also plane-fitting techniques but not spline fitting). The results of these experiments indicated that for the western part of The Netherlands, the choice of weights was not very critical and that opimization of weights was hardly necessary. This paper was a summary of a Research Report of the Royal Netherlands Mereorological Institute. (Roberts-ISWS)
W78-05766

THE SPEED AND DIRECTION OF MOVEMENT OF STORM RAINFALL PATTERNS WITH REFERENCE TO URBAN STORM SEWER DESIGN,
British Meteorological Office, Bracknell (England).
For primary bibliographic entry see Field 5B.
W78-05776

STATISTICAL EVALUATION OF RAINFALL-SIMULATOR AND EROSION TESTING PROCEDURE,
Louisiana Dept. of Highways, Baton Rouge. Research and Development Section.
For primary bibliographic entry see Field 2J.
W78-05785

INVESTIGATION OF THE DYNAMICS OF SNOW-COVER MELTING FROM METEOROLOGICAL-SATELLITE DATA,
For primary bibliographic entry see Field 2C.
W78-05788

ADEQUACY OF HYDROLOGIC DATA FOR APPLICATION IN WEST VIRGINIA,
West Virginia Univ., Morgantown. Water Research Inst.
For primary bibliographic entry see Field 7C.
W78-05931

NUTRIENT CONTENT AND PRECIPITATION OVER IOWA,
Iowa State Univ., Ames. Dept. of Agronomy.
For primary bibliographic entry see Field 5A.
W78-06020

HYDROGEN ION SPECIATION IN THE ACID PRECIPITATION OF THE NORTHEASTERN UNITED STATES,
Cornell Univ., Ithaca, NY. Section of Ecology and Systematics.
For primary bibliographic entry see Field 5A.
W78-06025

SOME REMARKS ON THE USE OF DAILY RAINFALL MODELS,
Agricultural Univ., Wageningen (Netherlands). Dept. of Land and Water Use; and Agricultural Univ., Wageningen (Netherlands). Dept. of Mathematics.
T. A. Buishand.
Journal of Hydrology, Vol. 36, No. 3/4, p 295-308, February 1978. 3 fig, 6 tab, 8 ref.

Descriptors: *Rainfall, *Synthetic hydrology, *Daily hydrographs, Rainfall intensity, Rain, Rain gages, Raindrops, Markov processes, Wet seasons, Equations, *Daily rainfall models, Alternating renewal processes, Cumulative relative frequencies.

Features of daily rainfall processes were described using data from different sites of the world. The process of rainfall occurrence was modelled by an alternating renewal process or by a Markov chain. It was shown that rainfall amounts within a wet spell are often neither independent nor identically distributed. There are, however, features of the rainfall process which are hardly sensitive to the choice of the process for the occurrence of wet days or to some assumptions about the behavior of the rainfall amounts, for example, the distribution of 30-day totals and the distribution of monthly extremes. The rainfall data were provided by the Meteorological Institutes of Great Britain, India, Indonesia, and the Netherlands. (Roberts-ISWS)
W78-06101

INTERCEPTION BY PINUS PATULA IN RELATION TO RAINFALL PARAMETERS,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2I.
W78-06104

TRENDS OF SEDIMENT REMOVAL FROM ARID SCREE SLOPES UNDER SIMULATED RAINSTORM EXPERIMENTS,
Hebrew Univ., Jerusalem (Israel). Dept. of Geography.
For primary bibliographic entry see Field 2J.
W78-06108

THE COLLECTION OF PRECIPITATION FOR CHEMICAL ANALYSIS,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
For primary bibliographic entry see Field 2K.
W78-06112

SEASONAL TRENDS OF NH4(+) AND NO3(-) NITROGEN ISOTOPE COMPOSITION IN RAIN COLLECTED AT JULICH, GERMANY,
Kerntorschungsanlage Juelich G.m.b.H. (West Germany). Inst. fuer Chemie.
For primary bibliographic entry see Field 5A.
W78-06113

FINAL REPORT TO THE NATIONAL SCIENCE FOUNDATION RESEARCH APPLIED DIRECTORATE WEATHER MODIFICATION ASSOCIATION,
Wyoming Univ., Laramie. Dept. of Atmospheric Science.
For primary bibliographic entry see Field 3B.
W78-06130

2C. Snow, Ice, and Frost

INVESTIGATION OF THE DYNAMICS OF SNOW-COVER MELTING FROM METEOROLOGICAL-SATELLITE DATA,
Yu. V. Kurilova, P. A. Kolosov, L. K. Poplavskaya, and Yu. S. Sokolov.
Soviet Hydrology: Selected Papers, Vol. 15, No. 1, p 1-6, 1976. 3 fig, 2 tab, 3 ref. Translated from Transactions of the State Hydrologic Institute (Trudy GGI), No. 237, p 22-31, 1976.

Descriptors: *Snow cover, *Melting, *Remote sensing, Satellites(Artificial), Data processing, On-site investigations, Spatial distributions, Analytical techniques, Methodology, Flood discharge, Foreign research, Ice, Hydrographs, Runoff, *USSR.

Various methodologica approaches to the study of the dynamics of snow cover melting from satellite data were analyzed. Snow cover melting was studied using the pictures obtained from the Meteor-10 satellite for March 1972. The orbit of this satellite crossed the eastern part of the European USSR, in particular the basins of the Don and Volga rivers. Information was received daily, and nearly cloud-free pictures of the underlying surface were obtained every 3-4 days. The dynamics of snow cover melting over the entire basin were determined from the change in the boundary of the zone of discontinuous snow cover and from changes in texture associated with melting patterns. The reliability of the snowmelt boundary, drawn from satellite data, was estimated by comparing it with the snow boundary on snow depth and water equivalent maps, constructed from conventional groundbased observations. This preliminary investigation showed that meteorological-satellite data can be used to determine the snow melting boundary and to estimate the proportion of melted snow in basins with areas exceeding 400 sq km. (Humphreys-ISWS)
W78-05788

ESTIMATION OF SNOW-COVER DYNAMICS FOR FORECASTS OF THE SPRING FLOOD IN THE GORNYY ALTAY FROM SATELLITE DATA,
N. V. Vostryakova, and A. M. Komlev.
Soviet Hydrology: Selected Papers, Vol. 15, No. 1, p 7-11, 1976. 4 fig, 2 tab, 15 ref. Translated from Transactions of the State Hydrologic Inst. (Trudy GGI), No. 237, p 32-40, 1976.

Descriptors: *Snow cover, *Spatial distribution, *Remote sensing, *Flood forecasting, Floods, Spring, Watersheds(Basins), Analytical techniques, Satellites(Artificial), Precipita-

tion(Atmospheric), Mountains, Snow, Foreign research, *USSR.

Systematic and detailed information on the state of the snow cover over large areas is required for analysis of the conditions of spring flood formation and its forecasting. Recent investigations in the Soviet Union and abroad showed the use of satellite information for this purpose to be promising. Reported were the first results of a study of snow cover dynamics in the Gornyy Altay from satellite data and an evaluation of the possibility of using them for spring flood forecasting. Snow cover cartograms of the Gornyy Altay were constructed from the features identified on the TV pictures for the period of April-November, when the seasonal variations in the height of the snow line are most distinct. Analysis of composite graphs showed that the variations in the height of the snow line obtained agree well with variations in meteorological conditions and, in particular, with the variations of the zero isotherm. Experimental interpretation of satellite pictures of the mountain regions of the Altay leads to the conclusion that further research in this direction is promising. (Humphreys-ISWS)
W78-05789

EMISSION CHARACTERISTICS OF MOIST STRATIFIED STRUCTURES IN THE VHF RANGE,
For primary bibliographic entry see Field 2G.
W78-05791

STUDY OF NEAR-INFRARED SNOW REFLECTANCE USING SKYLAB S192 MULTISPECTRAL SCANNER DATA,
Environmental Research and Technology, Inc., Concord.
J. C. Barnes, and C. J. Bowley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 504, Price codes: A04 in paper copy, A01 in microfiche. ERT Document No. 1474F, March 1977. 57 p, 19 fig, 1 tab, 9 ref. NOAA/NESS 635201.

Descriptors: *Remote sensing, *Snow cover, *Mapping, *Reflectance, Satellites(Artificial), Snowpacks, Snow, Data processing, Analytical techniques, Aerial photography, Mountains, Water resources, Infrared radiation, *Skylab data, S192 imagery.

Digital tape data (computer-compatible tapes) from the Skylab S192 Multispectral Scanner were analyzed to examine further the characteristics of snow reflectance in the near-infrared portion of the spectrum. The tapes used in the study were from four Skylab passes crossing mountainous terrain in the western United States, three in the winter from the Skylab-4 mission and one in the late spring from the Skylab-2 mission. In each case, the snow conditions were assessed through interpretation of the accompanying Skylab photography, snow reports, and meteorological data. The results of the investigation showed that the reflectance over a uniform snowpack is significantly lower in the near-infrared than in the visible or red-infrared portions of the spectrum. Overall, the refectances measured by the S192 Multispectral Scanner were in good agreement with snow reflectance measurement made from aircraft and in laboratory experiments. Because of the limited data sample, however, it was difficult to derive firm conclusions with regard to detecting in the spacecraft data the subtle differences that characterize different snow conditions in the laboratory experiments. Nevertheless, when the factors influencing the Skylab measurements were taken into consideration, the results substantiated the potential of using spacecraft near-infrared data to distinguish differing snow-cover conditions. Furthermore, the results of the analysis of one case also demonstrated the potential of using near-infrared data to distinguish automatically between cloud and snow. (Sims-ISWS)
W78-06120

ACOUSTIC EMISSION AND MECHANICAL PROPERTIES OF SNOW RELATED TO AVALANCHE RELEASE,
Montana State Univ., Bozeman.
R. L. Brown, T. E. Lang, and W. F. St. Lawrence.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-039 866, Price codes: A03 in paper copy, A01 in microfiche. Report 2-6000-694, March 1977. 23 p, 1 fig, 1 ref. ARO DAAG 29-76-G0037.

Descriptors: *Snow, *Avalanches, *Laboratory tests, *On-site investigations, Mechanical properties, Snow cover, Snowpacks, Slopes, Acoustics, Stability, Stress, Strength, *Snow properties, Acoustic emission, Snow slopes.

An evaluation was conducted of the physical and mechanical processes associated with snow avalanche initiation. Four separate tasks were involved in this effort: (1) a stress wave study to evaluate the response of snow to transient loads, (2) a slope stability investigation to determine the effectiveness of boundary conditions on slope stability, (3) a material constitutive representation to evaluate material properties for loads characteristically found in snow slopes, and (4) an acoustic emission study to investigate the process of slab release. Considerable progress was achieved in all portions of the project. An electromagnetic stress wave generator was constructed successfully and tested, and tests are now being carried out with this instrument. An equivalent linear viscoelastic model was formulated for snow for densities, temperature, and load conditions characteristic of alpine snow slopes. The acoustic emission field study is still gathering data, and a predictable pattern of acoustic emissions appears to be related to the process of fracture and avalanche initiation. The results of this one year project were reported in seven publications and symposium presentations. (Sims-ISWS)
W78-06129

PHOTOTACTIC AND THERMOTACTIC RESPONSES FACILITATING SURVIVAL OF CLOEON DIPTERUM (EPHEMEROPTERA) LARVAE UNDER WINTER ANOXIA,
Uppsala Univ. (Sweden). Inst. of Zoophysiology.
For primary bibliographic entry see Field 5C.
W78-06162

2D. Evaporation and Transpiration

STUDY OF THE PHYSICAL CHARACTERISTICS OF THE ACTIVE HORIZON OF UNDRAINED BOGS (ISSLEDOVANIE FIZICHESKIKH KHARAKTERISTIK DEYATELNOGO GORIZONTA NEOSUSHENNYKH BOLOT),
For primary bibliographic entry see Field 2I.
W78-05760

COMPUTATION OF EVAPORATION FROM TALUS AND ROCKS,
V. V. Golubtsov.
Soviet Hydrology: Selected Papers, Vol 15, No 1, p 37-38, 1976. 1 tab, 9 ref. Translated from Transactions of the Kazakh Hydrometeorological Scientific Research Institute (Trudy KazNIGMI), No 48, p 26-29, 1975.

Descriptors: *Evaporation, *Water loss, *Talus, *Rocks, Analytical techniques, Forecasting, Foreign research, Equations, Estimating, Foreign countries, *USSR.

Large areas in mountain basins at elevations exceeding 2500-3000 m are occupied by talus and rocks. One of the characteristic features of talus and rock surfaces is their very low water-holding capacity, for which reason losses by evaporation are relatively small. The proposed method of computing the water content and evaporation from talus was verified on the basis of the published data. Observed and computed values of evaporation from talus in the medium and high-mountain zones on the northern slope of the Trans-Ili Ala-Tau were tabulated. The observed and computed monthly evaporation values generally agreed fairly well and there were no systematic discrepancies between them. Similar results were obtained from a verification of the proposed method on the basis of observational data published in other papers. Therefore, this method was recommended for computing evaporation from surface occupied by talus and rocks. (Humphreys-ISWS)
W78-05795

COMPUTATION OF PRECIPITATION INTERCEPTION BY THE PLANT COVER,
For primary bibliographic entry see Field 2I.
W78-05796

DIURNAL TEMPERATURE DISTRIBUTION IN SMALL WATER RESERVOIRS (PHASE II),
Missouri Water Resources Research Center.
For primary bibliographic entry see Field 2H.
W78-05818

INTERFEROMETRIC OBSERVATIONS OF THE TEMPERATURE STRUCTURE IN WATER COOLED OR HEATED FROM ABOVE,
Purdue Univ., Lafayette, IN. Heat Transfer Lab.
R. Viskanta, M. Behnia, and A. Karalis.
Advances in Water Resources, Vol. 1, No. 2, p 57-69, December 1977. 10 fig, 27 ref. OWRT B-077-IND(2).

Descriptors: *Water temperature, *Cooling, *Heating, Stratification, Experiments, Flow, Convection, Temperature distribution, Equations.

Controlled laboratory experiments were performed in a water tank to study energy transfer during cooling and radiant reheating of water from above. Accurate instantaneous temperature measurements were obtained using a Mach-Zehnder interferometer which did not disturb the temperature, radiation, and flow fields. The buoyancy-induced flow field was visualized by employing an electro-chemical dye production technique. Cooling of an initially uniform layer of water and stratification-cooling-restratification were studied. The experimental observation during cooling of an initially uniform temperature column of water indicated intermittent free convection near the surface; this was characterized by randomly descending cooler plumes penetrating 10 to 25 cm into the warmer underlying region. The cooling rate had a decisive influence on the frequency and intensity of the descending parcels of water. For lower cooling rates the colder water usually descended in a form of sheets. Observations during cooling of initially stratified water showed that buoyancy driven convection occurred near the surface. The motion had an initial regular roll pattern, but as the cooling continued the roll pattern in the convective layer deteriorated into motion similar to that observed during cooling of an initially uniform temperature layer of water. When the water was restratified by radiant heating, the circulation in the convective layer was suppressed, and the temperature profiles obtained were similar to those observed in a fluid during free convection between two solid parallel walls. (Bell-Cornell)
W78-05942

THE EFFECT OF EVAPOTRANSPIRATION ON STREAMFLOW RECESSION,
Canterbury Univ., Christchurch (New Zealand). Dept. of Civil Engineering.
R. N. Weisman.
Hydrological Sciences Bulletin, Vol. 22, No. 3, p 371-377, September 1977. 5 fig, 2 tab, 8 ref.

Descriptors: *Evapotranspiration, *Streamflow, Effects, Evaporation, Water loss, Mathematical

studies, Equations, Recession curves, Low flow, Groundwater, Moisture, *Streamflow recession, *Recession constants, Pan evaporation.

The effect that evapotranspiration has on recession curves during low flow periods was explored. Recession constants were obtained from flow data and plotted against the average daily pan evaporation that occurred during the recession. The results for the three study basins were similar, showing a decrease in recession constant with an increase in average daily pan evaporation. For low values of average daily pan evaporation, the recession constant approached a constant value. The basins studied were chosen because they exhibited a range of values for their recession constants. This range in values was caused in part, if not wholly, by evapotranspiration from the riparian zone. The evapotranspiration caused a loss in moisture that would otherwise have been available to sustain a low flow. (Roberts-ISWS)
W78-06107

2E. Streamflow and Runoff

A GENERAL CLASS OF STOCHASTIC MODELS FOR HYDROLOGIC SEQUENCES,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 2A.
W78-05768

ANALYSIS OF HYDROLOGICAL RECESSION CURVES,
Commonwealth Scientific and Industrial Research Organization, Brisbane (Australia). Div. of Mathematics and Statistics.
P. N. Jones, and C. A. McGilchrist.
Journal of Hydrology, Vol 36, No 3/4, p 365-374, February 1978. 4 fig 2 tab, 2 ref.

Descriptors: *Recession curves, *Streamflow, *Hydrographs, *Model studies, Mathematical models, Runoff, River forecasting, Rivers, Water levels, Frequency curves, Hydrology.

A model for stream flow recession curves was developed. Data from three Australian rivers were used to illustrate how the effects of seasonality and storm input can be catered for by a relatively simple estimation procedure. It was suggested that a master recession curve does not give an dequate description of recession flows for a river. (Sims-ISWS)
W78-05769

A CRITERION OF EFFICIENCY FOR RAINFALL-RUNOFF MODELS,
University Coll., Galway (Ireland). Dept. of Engineering Hydrology.
For primary bibliographic entry see Field 2A.
W78-05770

DILUTION GAUGING ON THE RECESSION LIMB: 1. CONSTANT RATE INJECTION METHOD,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 8B.
W78-05774

THE SPEED AND DIRECTION OF MOVEMENT OF STORM RAINFALL PATTERNS WITH REFERENCE TO URBAN STORM SEWER DESIGN,
British Meteorological Office, Bracknell (England).
For primary bibliographic entry see Field 5B.
W78-05776

DEPENDENCE OF THE CORIOLIS AND BOUSSINESQ COEFFICIENTS ON THE SLOPE OF A MOUNTAIN STREAM,
V. V. Golubtsov.
Soviet Hydrology, Selected Papers, Vol 15, No 1, p 41-43, 1976. 1 fig, 1 tab, 15 ref. Translated from Transactions of the Kazakh Hydrometeorological Scientific Research Institute (Trudy KazNIGMI), No 48, 1975, p 96-100.

Descriptors: Flow, *Energy, *Velocity, *Distribution, *Streamflow, Streams, *Slope, Hydraulics, Mountains, Currents(Water), Natural flow, River flow, Foreign research, Foreign countries, Open channel flow, *USSR, *Coriolis coefficient, *Boussinesq coefficient, Momentum.

The Coriolis coefficient, alpha, is known to express in computations from the energy equation the ratio of the true energy to its value determined from average velocity. The Boussinesq coefficient alpha sub o is a correction in computations from the momentum equation, which brings the momentum determined from average velocity into correspondence with the true momentum. The values of alpha and alpha sub o must be known in various hydraulic computations. The dependence of alpha and alpha sub o on hydraulic parameters has not been studied sufficiently for mountain streams. In hydraulic manuals it is recommended that these coefficients be taken sufficiently close to unity. Several formulas have been proposed for determining both coefficients. The results of determinations of the coefficients from the formulas were tabulated. Comparison showed that the results of determinations of alpha and alpha sub o from the various formulas differ considerably. The probable reason for this is that the formulas in question were obtained proceeding from different theoretical premises and describe different conditions of streamflow. (Humphreys-ISWS)
W78-05797

CHARACTERISTICS OF SOME REGULARIZING PROCEDURES FOR DETERMINING THE MORPHOMETRIC CHARACTERISTICS OF A RIVER CHANNEL,
A. V. Romanov.
Soviet Hydrology: Selected papers, Vol 15, No 1, p 31-36, 1976. 3 fig, 5 ref. Translated from Transactions of the Hydrometeorological Center of the USSR (Trudy Gidromettsentra SSSR), No 168, p 38-50, 1975.

Descriptors: *Channel morphology, *Theoretical analysis, Mathematical studies, Analytical techniques, Equations, Continuity equation, Rivers, Hydraulics, Shape, Width, Water levels, Methodology, Algorithms, Mathematics, Foreign research, *USSR, Regularization parameters.

Experience in the use of St. Venant equations for computing unsteady flow in natural streams showed that it is most difficult to assign the morphometric and hydraulic characteristics of a river channel that enter these equations as coefficients. The author investigated some methodological problems of the numerical realization of some regularizing algorithms in solving the inverse problem for the continuity equation. Presented were methods of selecting the regularization parameter and also presented were analysis of the methods and description of the errors on the form of the regularization criteria. (Humphreys-ISWS)
W78-05798

WINTER FLOOD IN LENINGRAD ON DECEMBER 20, 1973,
B. A. Pomytkin.
Soviet Hydrology: Selected Papers, Vol. 15, No. 1, p72-74, 1976. 3 fig, 1 tab. Translated from News of the All-Union Geographic Society (Izvestiya VGO), No. 1, p 53-56, 1976.

Descriptors: *Floods, *Winter, *Foreign countries, *Storm surge, Cyclones, Weather, Ice, Storms, Water levels, Water level fluctuations, On-site investigations, Disasters, Tidal waters, *USSR, *Leningrad(USSR), *Gulf of Finland.

A winter flood (January-March) is rare and usually occurs when the Gulf of Finland or its eastern part is covered completely with ice, which markedly reduces the amplitude of the tidal wave and thus the rise in water level in the Neva delta. The last winter flood with a rise in level of 240 cm at Leningrad began in the early morning of December 20, 1973. It was caused by a cyclone that formed over the Scandinavian Peninsula in the Oslo region on December 19 and moved eastward at a speed of 60-70 km/hr, crossed the Baltic Sea at the end of the day of December 19, skirted Finland from the south, and reached Lake Ladoga at about 6 a.m. on December 20. The flood reached the Neva delta at 7h 20m on December 20 and raised the level at Leningrad by 189 cm. The wave component of this rise was estimated at slightly more than 1 m, while the wind tide accounted for 80-85 cm of this rise. The flood situation in the city, particularly distinct in its low western areas where the level was 1.5 m above normal stage, persisted for 3.5 hours (from 6 to 9 a.m.); it remained 2 m above normal stage for 2 hours, from 6 to 8 a.m. Huge piles of broken ice formed everywhere on the shore. (Humphreys-ISWS)
W78-05800

DEVELOPMENT OF A VERSION OF STANFORD MODEL AND ITS EVALUATION FOR STREAMFLOW SYNTHESIS FROM SMALL WATERSHEDS IN WEST VIRGINIA,
West Virginia Univ., Morgantown. Dept. of Agricultural Engineering.
A. M. Chaudhry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 540, Price codes: A09 in paper copy, A01 in microfiche. PhD Thesis, 1975. 178 p, 30 fig, 26 tab, 67 ref, 3 append. OWRT A-021-WVA(2).

Descriptors: *Streamflow forecasting, Model studies, *Mathematical models, *Computer models, *Computer programs, *West Virginia, *Watershed(Basins), Surface runoff, Forecasting, Estimating, *Agricultural watersheds, *Stanford Streamflow Model, *FORTRAN.

A FORTRAN version of the Stanford Streamflow Model was used to generate 3-5 years of streamflow data on 2 small agricultural watersheds located on the West Virginia University Animal Husbandry Farm. Three years of recorded data were used to calibrate the model. Three statistical summaries were made; good prediction of streamflow on an annual basis and fairly good prediction on a monthly basis were obtained. Storm hydrographs were predicted less accurately. The sensitivity of several model parameters was evaluated by holding the value of all parameters constant, while one variable was ranged from a low to a high value. Surface runoff estimates were particularly sensitive to changes in average roughness coefficient for overland flow in soil surfaces (MANP), mean overland flow length in feet (LENGTH), and average slope in feet per foot of the overland flow surfaces perpendicular to the channel (S). The most important parameters appeared to be the interflow index (CC), infiltration index (CBI), nominal lower zone storage (FLZSN), ratio of the lower zone storage to the nominal value (FLZS/FLZN), and an infiltration-evaporation index (EF) for applying a seasonal variation to infiltration. Several of the deviations of the simulated from actual flow can be traced directly to simple mathematical expressions used in the model for the natural processes which are too complex to permit an intricate analysis. The model appears to simulate the hydrologic processes within the accuracy of the basic input data. (Seip-IPA)
W78-05808

ADEQUACY OF HYDROLOGIC DATA FOR APPLICATION IN WEST VIRGINIA,
West Virginia Univ., Morgantown. Water Research Inst.
For primary bibliographic entry see Field 7C.
W78-05931

DEVELOPMENT OF A SUBSURFACE HYDROLOGIC MODEL AND USE FOR INTEGRATED MANAGEMENT OF SURFACE AND SUBSURFACE WATER RESOURCES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W78-05934

ESTIMATES OF LOW FLOWS USING WATERSHED AND CLIMATIC PARAMETERS,
Stephen F. Austin State Univ., Nacogdoches, TX. School of Forestry.
M. Chang, and D. G. Boyer.
Water Resources Research, Vol. 13, No. 6, p 997-1001, December 1977. 4 fig, 5 tab, 16 ref. OWRT A-023-WVA(2).

Descriptors: *Low flow, *Climatology, *West Virginia, Low flow frequency, Statistics, Forecasting, Watersheds(Basins), Runoff, Rainfall, Precipitation(Atmospheric), Droughts, Topography, Temperature, Climates, Rainfall-runoff relationships, Mathematical models, *Monongahela watershed(W Va).

The lowest 7-day streamflows (10-yr return period) of 12 Monongahela tributaries in West Virginia were estimated from watershed and climatic parameters. Of the parameters studied, watershed perimeter alone accounted for about 88% of the spatial variability of 7-day low flows in a multiple-regression analysis. Main channel length and watershed form increased the predictability to about 95%. Precipitation and temperature parameters, which were highly correlated with watershed elevation and latitude, raised the R sq to 0.999. The standard error of estimate was 7.43 cu ft/s, or about 30% of the observed mean; this result, an order of magnitude smaller than that obtained in an earlier study, suggests that meaningful low-flow estimates can be obtained from watershed parameters alone in a mountainous humid region. (Sims-ISWS)
W78-05944

GENERATING RAINFALL EXCESS BASED ON READILY DETERMINABLE SOIL AND LAND-USE CHARACTERISTICS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2A.
W78-05945

THE ANALYSIS OF MULTIVARIATE TIME SERIES APPLIED TO PROBLEMS IN HYDROLOGY,
International Inst. of Applied Systems Analysis, Laxenburg (Austria).
J. Ledolter.
Journal of Hydrology, Vol. 36, No. 3/4, p 327-352, February 1978. 21 ref, 1 append.

Descriptors: *Hydrology, *Statistical models, *Time series analysis, Synthetic hydrology, Equations, Mathematical studies, Mathematics, Model studies, Analysis, Stochastic processes, *Multivariate time series, Stochastic models, Vector process.

Stochastic models for vector processes, in particular the class of multivaritate autoregressive moving average models were discussed. Special cases of this class have been discussed in the literature on synthetic hydrology, and it was shown how these results can be brought into a general framework. An iterative model building procedure, consisting of model specification-estimation-diagnostic checking, was stressed. Results on model specification were given, and it was shown how partial autocovariance matrices can be used to check whether multivariate autoregressive models provide adequate representation for (standardized) streamflow sequences. Furthermore, estimation of parameters in multivariate autoregressive moving average models was discussed, and it was pointed out that moment estimators can be inefficient when moving average parameters are present. An approximate maximum likelihood estimation procedure was suggested. Furthermore, an inconsistency in modelling hydrologic sequences was pointed out; it was shown that, in general, it is not possible to have the individual series in a multivariate (first-order) autoregressive process follow univariate processes of the same (first) order. (Lee-ISWS)
W78-06102

THE EFFECT OF EVAPOTRANSPIRATION ON STREAMFLOW RECESSION,
Canterbury Univ., Christchurch (New Zealand). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2D.
W78-06107

STATISTICAL METHODS IN HYDROLOGY,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 7C.
W78-06125

2F. Groundwater

COMPUTER MODELLING OF GROUNDWATER 13C AND 14C ISOTOPE COMPOSITIONS,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
E. J. Reardon, and P. Fritz.
Journal of Hydrology, Vol 36, No 3/4, p 201-224, February 1978. 3 fig, 3 tab, 16 ref, 5 append.

Descriptors: *Groundwater, *Isotope studies, *Carbon, *Computer models, Mathematical models, Model studies, Computer programs, Water chemistry, Carbon radioisotopes, Carbonate rocks, Carbonates, Carbon dioxide, Hydrogen ion concentration, Radioactive dating, Hydrology.

A 13C and 14C isotope subroutine called ISOTOP has been written for WATEQF, a FORTRAN IV version of the water-analysis treatment program (WATEQ) translated and modified from the original PL1 version. This subroutine performs a series of simulations of water samples where 13C and 14C data are available by assuming various initial pH and -log (P sub C02) values under open-system conditions and computing the variation of 13C of the C02 gas phase to be compared with the actual water sample's value and an age for each simulation applied. Some of the models use total Ca plus Mg as a measure of whole-rock carbonate dissolved under closed-system conditions, while other models make corrections for gypsum dissolution and ion-exchange reactions. In additin, the subroutine may be used to compute age differences between pairs of water samples along the same flow path using congruent and incongruent carbonate dissolution models. In the simulations applied, carbonate and bicarbonate in pairing and complexing were considered. (Sims-ISWS)
W78-05767

DETERMINATION OF UNIFORM AND GRANULAR AQUIFER CHARACTERISTICS BY LINEAR METHODS,
Gerede Sokat, Ankara (Turkey).
O. Dumlu.
Hydrological Sciences Bulletin, Vol 22, No 3, p 413-419, September 1977. 3 fig, 2 tab.

Descriptors: *Aquifers, *Drawdown, *Aquifer characteristics, *Analytical techniques, Model studies, Mathematical models, Wells, Water wells, Pumping, Data processing, Graphical methods, Graphical analysis, Groundwater, Groundwater movement, Hydrology.

It is known fact that some methods used in the calculation of aquifer coefficients for unconsolidated formations require the use of semilogarithmic and logarithmic papers, and other methods need previously prepared tables. In this study, some linear methods were considered for the determination of aquifer characteristics because of the greater possibilities they give for accurate drawing of the drawdown/time graph. (Sims-ISWS)
W78-05775

CHARACTERISTICS OF THE INTERRELATION OF SURFACE AND GROUND WATERS IN THE KARAKENGIR RIVER BASIN WITH A DISTURBED NATURAL REGIME,
S. P. Rylov.
Soviet Hydrology, Selected Papers, Vol 15, No 1, p 44-49, 1976. 3 fig, 3 tab, 5 ref. Translated from Transactions of the Kazakh Hydrometeorological Scientific Research Institute (Trudy Kazakhskogo Nauchno-Issledovatel'skogo Gidrometeorologicheskogo Instituta), No 48, p 132-141, 1975.

Descriptors: *Runoff, *Groundwater, *Groundwater recharge, Measurement, On-site investigations, Model studies, Recharge, Precipitation(Atmospheric), Aquifers, Water levels, Rivers, Groundwater movement, Infiltration, Surface waters, Evaporation, Withdrawal, Water wells, Hydrology, *USSR.

The hydrologic and hydrogeological investigations performed by the Kazakh Hydrometeorological Scientific Research Institute in 1969-1972 in Dzhezdy district of Dzhezkazgan Province made it possible to refine and, in some cases, to obtain anew the quantitative characteristics of the interrelation of surface and groundwaters. The studies were performed 60 km to the north of Dzhezkazgan within the Aydos brachyanticlinal structure. The Karakengir River, which crosses this structure, has a basin area of 9380 sq km at the outlet gaging station. In the reach within the structure, the two-sided floodplain 600-1600 m wide is dissected by arms and oxbows and the river channel consists of a chain of deep (4-6 m) pools. The reach studied begins 2 km upstream of the confluence of Uronsay Ravine, where the gaging station Verkhniy is located, and ends at the gaging station Nizhniy in the Aydos village area. To determine the losses of Karakengir runoff and the recharge of the groundwaters of the structure, the following observations and computations were performed: the inflow and outflow of water along the Karakengir in the reach under study were taken into account, precipitation and evaporation in the flood plain were determined, and the groundwater levels in wells and the magnitude of water withdrawal were measured. Meteorological observations were made at Aydos station. To determine lateral inflow between the reference gaging stations, runoff was measured in the mouth areas of all ravines. Summer precipitation and the maximum water equivalent of snow in the flood plain were determined from direct measurements, and evaporation from the flood plain was determined by establishing and using its dependence on the air moisture deficit, according to the GGI-3000 evaporimeter data. Groundwater-level observations were made in 12 wells in the alluvium of the Karakengir River and in 30 wells in the remaining part of the structure. (Sims-ISWS)
W78-05794

A PUMP TEST IN THE DAKOTA SANDSTONE AT WALL, SOUTH DAKOTA,
South Dakota School of Mines and Technology, Rapid City. Dept. of Geology and Geological Engineering.

For primary bibliographic entry see Field 4B.
W78-05946

DISPERSION CALCULATIONS IN NONUNIFORM SEEPAGE,
Canterbury Univ., Christchurch (New Zealand). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W78-06099

IDENTIFICATION OF DISTRIBUTED PARAMETERS IN GROUNDWATER BASINS,
James Cook Univ. of North Queensland, Townsville (Australia). Dept. of Civil Engineering.
V. Guvanasen, and R. E. Volker.
Journal of Hydrology, Vol. 36, No. 3/4, p 279-293, February 1978. 7 fig, 3 tab, 21 ref.

Descriptors: *Groundwater movement, *Aquifers, *Groundwater, *Model studies, Mathematical models, Calibrations, Recharge, Discharge(Water), Transmissivity, Potentiometric level, Water levels, Storage, Analytical techniques, Hydrology.

A method for evaluating parameters in an equation describing groundwater flow in two-dimensional space was presented. The method employs finite-difference approximations and the assumption of a limit on the local variability of transmissivity or hydraulic conductivity. The approach entails a systematic minimization of the difference between recorded and calculated water levels using the Newton-Raphson technique along a path in such a way that the calibrated regions are isolated from the rest. Illustrations of the application of this scheme are those from an idealistic rectangular water-table aquifer and a real water-table aquifer system. The method is successful in retrieving the true values of parameters provided that the other data are accurate. In the case of noisy data, a set of parameters capable of faithfully reproducing the recorded water levels with minimum deviation was obtained. (Sims-ISWS)
W78-06100

GROUND-WATER RESOURCES OF EMMONS COUNTY, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 4B.
W78-06179

SELECTED HYDROLOGIC DATA, PAROWAN VALLEY AND CEDAR CITY VALLEY DRAINAGE BASINS, IRON COUNTY, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-06180

RECORD OF GROUND-WATER EXPLORATION AND DEVELOPMENT, 1975-76, MOEN, TRUK, EASTERN CAROLINE ISLANDS,
Geological Survey, Honolulu, HI. Water Resources Div.
For primary bibliographic entry see Field 4B.
W78-06193

LAND-SURFACE SUBSIDENCE IN THE HOUSTON-GALVESTON REGION, TEXAS,
Geological Survey, Houston, TX. Water Resources Div.
R. K. Gabrysch.
In: Proceedings of the Anaheim Symposium, December 1976: International Association of Hydrological Sciences Publication No 121, p 16-24, 1976. 5 fig, 7 ref.

Descriptors: *Land subsidence, *Aquifers, *Pumping, *Drawdown, *Texas, Groundwater, Withdrawal, Compaction, Groundwater recharge, Aquifer management, Projections, Evaluation, Hydrogeology, Harris County(Tex), Galveston County(Tex).

Development of ground water in the Houston-Galveston region, Texas, began in the 1890's. Pumping of ground water from the Chicot and Evangeline aquifers for municipal supply, industrial use, and irrigation was about 23 cubic meters per second by 1974. Pumping of large amounts of ground water has resulted in water-level declines during 1943-73 of as much as 61 meters in wells completed in the Chicot aquifer and as much as 99 meters in wells completed in the Evangeline aquifer. The declines in artesian pressures have resulted in pronounced regional subsidence of the land surface. The center of subsidence is east-southeast of Houston at Pasadena, where as much as 2.3 meters of subsidence occurred between 1943 and 1973. The maximum amount of subsidence during 1964-73 was about 1.1 meters. The area in which subsidence is 0.3 meter or more has increased from about 906 square kilometers in 1954 to about 6,475 square kilometers in 1973. Water from Lake Livingston on the Trinity River, about 97 kilometers east of Houston, will become available in 1976. As a result, it is estimated that groundwater pumping will decrease by about 3.1 cubic meters per second in the area of maximum artesian-pressure decline and subsidence. The recovery of water levels is expected to decrease the rate of subsidence substantially. (Woodard-USGS)
W78-06195

ESTIMATING PARAMETERS OF COMPACTING FINE-GRAINED INTERBEDS WITHIN A CONFINED AQUIFER SYSTEM BY A ONE-DIMENSIONAL SIMULATION OF FIELD OBSERVATIONS,
Geological Survey, Sacramento, CA. Water Resources Div.
D. C. Helm.
In: Proceedings of the Anaheim Symposium, December 1976: International Association of Hydrological Sciences Publication No 121, p 145-156, 1976. 12 fig, 1 tab, 4 ref.

Descriptors: *Aquitards, *Computer models, *Land subsidence, Mechanical properties, *California, Aquifer characteristics, Clays, Compaction, Compressibility, Consolidation, Stress, Hydraulic conductivity, Hydrologic properties, Mathematical models, Model studies, Permeability, Physical properties, Soil mechanics, Storage coefficient, Specific capacity, Geomorphology.

A one-dimensional mathematical model that calculates idealized aquifer-system compaction and expansion has been applied to observed water-level fluctuations and to the resulting observed transient compaction-and-expansion behavior of a total thickness interval at one site in the San Joaquin Valley and at several sites in the Santa Clara Valley, Calif. Values for total cumulative thickness (b'sum) of fine-grained interbeds within the confined aquifer system, the weighted-average thickness (b'equiv) of these interbeds, recoverable vertical compressibility (S'ske), and the initial distribution of preconsolidation pressure - p'max(z, 0) - must be approximated from field data independently of any subsequent simulation process. Only values for vertical components of hydraulic conductivity (K') and nonrecoverable compressibility (S'skv) are adjusted by trial-and-error to fit calculated to observed compaction history. The estimated values for K' at the sites studied range from 1.7 x 10 to the minus 7th power to .0000038 m/day, those for S'skv range from .00046 to .0043 m-1, and those for S'ske range from .0000072 to .000052 m-1. For established values of b'sum, b'equiv, and p'max(z, 0), carefully evaluated values of K' and S'skv can be used to predict aquifer-system behavior with reasonable accuracy over periods of several decades. (Woodard-USGS)
W78-06196

HYDROGEOLOGIC EFFECTS OF SUBSIDENCE, SAN JOAQUIN VALLEY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W78-06197

LAND SUBSIDENCE STOPPED BY ARTESIAN-HEAD RECOVERY, SANTA CLARA VALLEY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W78-06198

2G. Water In Soils

EFFECT OF SOIL HEAT FLUX ON THE WATER BALANCE OF A SMALL CATCHMENT,
Waikato Univ., Hamilton (New Zealand). Dept. of Earth Sciences.
I. Simmers.
Hydrological Sciences Bulletin, Vol 22, No 3, p 433-445, September 1977. 4 fig, 3 tab, 16 ref, 1 append.

Descriptors: *Water balance, *Heat flow, *Soil moisture, *Model studies, Mathematical models, On-site investigations, Watersheds(Basins), Rainfall, Runoff, Storage, Water storage, Evapotranspiration, Hydrology, *River Ray Basin(England).

A study of the water balance of the upper River Ray basin revealed that calculated soil moisture storage exceeds measured storage in winter and falls well below it in summer. The systematic seasonal error is of the order + or - 50 mm. Several reasons have been proposed which may account for some local water balance anomalies. However, the reported discrepancies are characteristic of a much broader area and are attributed partly to the omission of a soil heat storage term (G) from the Penman equation. The reported analysis tested this hypothesis. Soil heat flux was measured directly at the Grendon Underwood climatological station and was found to be smal in relation to other water balance components. Inclusion of the term in the Penman equation was not enough in itself to account for the published seasonal moisture anomalies. With a change of neutron probe from that used n the earlier study, and inclusion of G in the calculations, the 50 mm inbalance can be reduced to + 34 mm and -18 mm for the summer and winter half years, respectively. (Sims-ISWS)
W78-05777

FALLOUT CESIUM-137 IN CULTIVATED AND NONCULTIVATED NORTH CENTRAL UNITED STATES WATERSHEDS,
Agricultural Research Service, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 5B.
W78-05779

STATISTICAL EVALUATION OF RAINFALL-SIMULATOR AND EROSION TESTING PROCEDURE,
Louisiana Dept. of Highways, Baton Rouge. Research and Development Section.
For primary bibliographic entry see Field 2J.
W78-05785

EMISSION CHARACTERISTICS OF MOIST STRATIFIED STRUCTURES IN THE VHF RANGE,
A. Ye. Popov, Ye. A. Sharkov, T. A. Shiryayeva, and V. S. Etkin.
Soviet Hydrology: Selected Papers, Vol 15, No 1, p 15-17, 1976. 3 fig, 6 ref. Translated from Transactions of the State Hydrologic Institute (Trudy GGI), No 237, p 143-147, 1976.

Descriptors: *Remote sensing, *Soil moisture, *Moisture content, *Theoretical analysis, Radio waves, Frequency, Mathematical models, Analysis, Analytical techniques, Foreign research, Wavelengths, Infiltration, Radiation, *USSR, *Very high frequency range.

Radiometric methods are effective for remote hydrologic investigations. Unlike infrared methods, the effective radio emission layer is fairly thick for the VHF range (from several centimeters to several meters), and therefore, radiometric methods can be used not only to detect subterranean water and ice, but also to study the dynamics of water penetration into the soil. Theoretical investigation of the ratio emission of moist structures is generally limited to the study of the simplest homogeneous models. Radio emission was analyzed of some more complex moist stratified structures and the possibilities of determining some hydrologic parameters by the multiple-frequency method. Water under a soil layer, ice or frozen ground under a soil layer, soil layers with different moisture contents, etc., can satisfy the adopted idealization (layers with smooth boundaries) under natural conditions. (Humphreys-ISWS)
W78-05791

SOME RESULTS OF MEASUREMENTS OF THE RADIO EMISSION OF SOILS USING A HIGHLY SENSITIVE AIRCRAFT RADIOMETER WITH A 3-CM WAVE RANGE,
Ye. A. Bespalova, V. V. Melent'yev, Yu. I. Rabinovich, and V. Yu. Rayzer.
Soviet Hydrology: Selected Papers, Vol 15, No 1, p 18-20, 1976. 3 fig, 5 ref. Translated from Transactions of the State Hydrologic Institute (Trudy GGI), No 237, p 172-176, 1976.

Descriptors: *Soils, *Radiation, *Remote sensing, Radio waves, Statistical methods, Analysis, Analytical techniques, Measurements, On-site investigations, Instrumentation, Temperature, Data processing, Foreign research, *USSR, Radiometers.

Some results were reported of radiothermal investigations of semidesert and swampy regions in the lower courses of the Amu-Dar'ya and Ural rivers and of a tentative correlation-statistical analysis of these regions. In 1973 the radiothermal emission of earth covers were investigated from an IL-18 aircraft-laboratory with a 3-cm radiometer. This radiometer is a straight-amplification modulation radiometer with four tunneldiode amplifier stages. The normalized spectra of two different waterlogged areas were very similar qualitatively and also quantitatively in their high-frequency portion. In the two areas in question, the characteristic dimensions in the fields of radioluminance temperatures have distinct features: two high-frequency peaks, which correspond to features (periodicities) with characteristic dimensions of 1.2 and 1.7 km, and two lower-frequency peaks with characteristic dimensions of 2.2 and 5 km. Another important conclusion follows from analysis of these spectra: since the records were made on flights in different directions, the field of random values of radioluminance temperatures is probably spatially isotropic. The main result obtained is that statistical methods can be used to analyze the fields of radioluminance temperatures (for aircraft observations), and that they give fairly explicit and interpretable results. (Humphreys-ISWS)
W78-05792

COMPUTATION OF THE SOIL MOISTURE PROFILE FROM HYDROMETEOROLOGICAL DATA,
L. S. Kuchment, and G. P. Zhmayeva.
Soviet Hydrology: Selected Papers, Vol 15, No 1, p 27-30, 1976. 2 fig, 2 tab, 4 ref. Translated from Transactions of the Hydrometeorological Center of the USSR (Trudy Gidrometsentra SSSR), No 168, p 16-23, 1975.

Descriptors: *Soil moisture, *Profiles, *Analytical techniques, Analysis, Finite element analysis, Numerical analysis, Data processing, Hysteresis, Diffusion, Mathematical models, Mathematical studies, Foreign research, *USSR.

Experimental data showed that the hydraulic permeability of soils depends largely on the type of soil and its moisture content and varies in time and over the area of a basin. The hysteresis of moisture conductivity, produced by a change in the suction force of the soil during alternation of wetting and drying, markedly complicates the dependence of this coefficient on the soil moisture content. An even stronger hysteresis effect is observed in the moisture characteristic of the soil. Numerical experiments showed that the moisture diffusion coefficient plays a determining role in the description of soil moisture dynamics over a long period. The values of the moisture diffusion coefficients for hysteresis conditions were tabulated. At some instants of time, particularly when soil moisture measurements were made directly after a rainfall, the middle part of the soil moisture profile sometimes has noticeable errors because of delays or advances of variations in the profile. However, these errors attenuate rapidly. Numerical values of the moisture diffusion coefficient were tabulated for various points. (Humphreys-ISWS)
W78-05793

SEDIMENTATION AND SOIL ALTERATION, MONROE RESERVOIR, INDIANA,
Indiana Univ., Bloomington. Dept. of Geology.
For primary bibliographic entry see Field 2J.
W78-05815

INFILTRATION FORMULA BASED ON SCS CURVE NUMBER,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
G. Aron, A. C. Miller, Jr., and D. F. Lakatos.
Journal of the Irrigation and Drainage Division, Proceedings of ASCE, Vol. 103, No. IR4, p 419-427, December, 1977. 3 fig, 4 tab, 9 ref, 1 append.

Descriptors: *Infiltration, *Rainfall-runoff relationships, *Soil properties, *Storage capacity, *Permeability, Hydrologic cycle, Precipitation excess, Runoff coefficient, Hortons Law, Waste water disposal, Municipal wastes.

An equation for determining infiltration based on rainfall, runoff, and soil water storage capacity is presented as an alternative to Hortons Law. The infiltration equation utilizes United States Soil Conservation Service (SCS) runoff equations and soil curve numbers. The SCS formula for cumulative infiltration is dependent upon hydrologic soil complex curve numbers, which are based on soil permeability and land use, and soil water storage capacity. The infiltration equation based on the SCS formula is used to determine the cumulative infiltration as a function of soil characteristics and antecedent infiltration. The equation is reported to be adaptable to computer models and to eliminate the need for extensive on-site field tests because of the SCS soil properties and curve numbers used. (Lisk-FIRL)
W78-05819

THE MIGRATION OF 238U, 226RA, 232TH AND 40K INTO FLOODPLAIN SOILS OF SUPERAQUATIC LANDSCAPES OF THE BITYUG RIVER, (IN RUSSIAN),
Moscow State Univ. (USSR). Dept. of General Soil Science.
For primary bibliographic entry see Field 5B.
W78-05822

BIOLOGICAL ACTIVITY OF SODDY-PODZOLIC SOILS UNFLOODED AND FLOODED BY THE WATER OF MOZHAISK RESERVOIR, (IN RUSSIAN),
Moscow State Univ. (USSR). Dept. of Physics; and Moscow State Univ. (USSR). Dept. of Soil Melioration.
V. E. Korenevskaya, V. I. Duda, I. S. Reshetova, I. A. Kostromina, and A. S. Nikiforova.
Vestn Mosk Univ SER Vi Biol Pochvoved 31(4), p 78-86, 1976.

Descriptors: *Soil moisture, Bacteria, Biological communities, Catalase, *Flooded soils, Invertase, *Anaerobic microorgnisms, Nitrification, Podzolic soils, Reservoirs, Respiration, Soddy, Soils, *Unflooded soils, Urease, *Nitrifying bacteria, *Mozhaisk Reservoir(USSR).

The flooding of derno-podzolic soils by waters of the Mozhaisk Reservoir, USSR is accompanied by a total rebuilding of complex biological processes in the soils; the quantity of aerobic microorganisms decreases, as revealed on various nourishing substrates; the quantity of anaerobic microorganisms grown on soil agar increases; the activity of nitrification bacteria is suppressed; the activity of catalase, urease and invertase decreases. The intensity of respiration in fresh samples at high moisture is higher in a flooded soil. In preliminary dryed samples the intensity of respiration in the moisture interval from 30-100 relative per cent is considerably higher in unflooded derno-podzolic soils in the flooded ones.--Copyright 1977 Biological Abstracts, Inc.
W78-05827

INFLUENCE OF ARTIFICIAL DRAINAGE ON PENETRATION OF COLIFORM BACTERIA FROM SEPTIC TANK EFFLUENTS INTO WET TILE DRAINED SOILS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W78-05881

BEHAVIOR OF ANIONIC SURFACTANTS IN A SOIL-SEWAGE EFFLUENT SYSTEM,
Agricultural Research Organization, Bet Dagan (Israel). Inst. of Soils and Water.
For primary bibliographic entry see Field 5B.
W78-05900

IMPROVING SUBSURFACE DISPOSAL SYSTEM PERFORMANCE,
Agricultural Research Center, Beltsville, MD.
For primary bibliographic entry see Field 5E.
W78-05901

NITRATE LEACHING DURING LONG-TERM SPRAY IRRIGATION FOR TREATMENT OF SECONDARY SEWAGE EFFLUENT ON WOODLAND SITES,
Pennsylvania State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W78-05903

APPLICATION OF HEAT-FLOW TEMPERATURE MODEL FOR REMOTELY ASSESSING NEAR SURFACE SOIL MOISTURE BY THERMOGRAPHY,
South Dakota State Univ., Brookings. Dept. of Physics.
J. A. Tunheim.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 616, Price codes: A03 in paper copy, A01 in microfiche. South Dakota Water Resources Research Institute, Brookings, Completion Report, November 1977. 44 p, 11 fig, 14 tab, 15 ref, append. OWRT A-053-SDAK(1). 14-31-0001-6043.

Descriptors: Groundwater, *Thermography, Thermal prospecting, *Saline seeps, *Soil tempera-

tures, *Soil moisture, *Remote sensing, Soil profile, Seepage, Model studies, Thermometers, Instrumentation.

Experimental and theoretical investigations were carried out relating to the detection and mapping of near-surface groundwater by the use of remote sensed thermal emittance data (thermography). The specific focus of the study was the detection of saline seeps in their pre-emergence stages. Soil temperature profiles, water table depths and other pertinent data were collected in two potential seep areas. The data were related to thermal emittance acquired during three aircraft flights and results were used to modify a theoretical model. Recommendations were also made for scheduling thermography flights. Conclusions are: (1) Thermography flights for the detection of potential seep areas should be scheduled in early spring or late fall to avoid heavy crop cover. They should also be scheduled early in the night since thermal emittance and shallow soil temperatures correlate best with water table depths at this time. (2) The purely conduction model previously proposed for relating soil temperature patterns to the presence of near surface groundwater is not valid in the case of saline seeps. Thus any model relating thermal emittance to a potential saline seep must consider other factors such as differences in soil moisture. (Wiersma-South Dakota)
W78-05932

PHOSPHORUS DYNAMICS IN SOILS IRRIGATED WITH MUNICIPAL WASTEWATER,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 5D.
W78-05937

DETERMINATION OF SOIL HUMUS CONTENT WHEN CONDUCTING FIELD EXPERIMENTS ON ERODED SOILS, (IN RUSSIAN),
Moscow State Univ. (USSR). Faculty of Geography.
M. N. Zaslavskii, and A. B. Levin.
Pochvovedenie 6, p 138-146, 1976.

Descriptors: *Soil erosion, *Humans, Geomorphology, Cover crops, Heterogeneity, Lithology, Morphology, Soils.

Fields experiments on slopes demand a preliminary study of geomorphological, lithological and soil-genetic conditions, and a thorough investigation of soil cover heterogeneity in respect to soil erodibility. This depends on the relationship between relative decrease in soil humus content and crop. The study of the soil cover structure on slopes helps make a right choice of the field plot and accounts for the effect of the heterogenous distribution of eroded soils on experimental results.--Copyright 1977, Biological Abstracts, Inc.
W78-05943

EFFECT OF LAND DISPOSAL APPLICATIONS OF MUNICIPAL WASTES ON CROP YIELDS AND HEAVY METAL UPTAKE,
National Fertilizer Development Center, Muscle Shoals, AL.
For primary bibliographic entry see Field 5B.
W78-05985

USE OF CLIMATIC DATA IN ESTIMATING STORAGE DAYS FOR SOILS TREATMENT SYSTEMS,
Environmental Data Service, Asheville, NC.
For primary bibliographic entry see Field 5E.
W78-05993

ENGINEERING AND PEDOLOGICAL PROPERTIES OF SOILS AS THEY AFFECT SOIL ERODIBILITY,
California Univ., Davis. Dept. of Land, Air, and Water Resources; and California Univ., Davis. Dept. of Civil Engineering.
M. Singer, J. Blackard, E. Gillogley, and K. Arulanandan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 856, Price codes: A03 in paper copy, A01 in microfiche. Technical Completion Report, Contribution No. 166, Water Resources Center, January 1978. 32 p, 18 fig, 17 tab, 59 ref. (Project UCAL-WRC-W-502).

Descriptors: *Erosion, *Erosion rates, *Mulching, Soil management, *Soil erosion, *Soil physical properties, Sediments, *Vegetation effects, Soil-water-plant relationships, Soil chemical properties, *California, Cover crops.

This study evaluated the erodibility of three major range soils through field study. A persistent drought during the study period prevented the collection of meaningful data from the field plots. Rainfall from a small laboratory simulator was used to evaluate the relative erodibilities of eight extensive California soils. The physical, chemical, and engineering properties of these soils were determined in the laboratory and related to the relative erodibility of the soils. Critical shear stress, SAR, and dithionite iron content are three measureable properties of soils found to be important in determining their relative erodibility. The relationship between mulch cover percentage and sediment in surface runoff from simulated rainfall was also studied for oat, straw, oak leaf, and redwood litter mulches. A single model was insufficient to accurately show the relationship between soil cover percentage and soil loss. The relationship between soil cover percentage and soil loss was generally parabolic but this does not include soil splash. (Snyder-Calif, Davis)
W78-06036

FUNDAMENTAL STOCHASTIC MODELS OF THE TRANSPORT OF WATER AND SOLUTES THROUGH SATURATED AND UNSATURATED POROUS MEDIA,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
V. K. Gupta, G. Sposito, and R. N. Bhattacharya.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 772, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, December 1977. 47 p, 42 ref. OWRT B-052-ARIZ(3), 14-34-0001-7136.

Descriptors: Porous media, Model studies, Solutes, *Solute transport, *Soil water movement, Markov processes, Theoretical studies, *Stochastic models, *Transport models(Soils).

The theories that have been employed to derive the macroscopic partial differential equations that describe solute transport through porous media are reviewed critically. These foundational theories may be grouped into three general classes: (I) approaches based in fluid mechanics, (II) approaches based in the theory of Markov processes, and (III) approaches based in a formal analogy between statistical thermodynamics and hydrodynamic dispersion. The theories of Class I are open to serious question, among other things because of their use of highly artificial models of porous media and because of their tacit and unproved assumption that solutions of the equations of fluid mechanics exist at the pore level. The theories of Class II tend to suffer from the absence of a firm dynamical basis for the stochastic properties they attribute to the velocity of a solute molecule. The theories of Class III can be either purely formal in nature, with an unclear physical content, or equivalent to well known phenomenological theories that make use of the analogy between heat and matter flow at the macroscopic level. None of the existing foundational theories has yet achieved its objective of deriving in a physically meaningful and mathematically rigorous fashion the macroscopic differential equations of subsurface solute transport theory.
W78-06064

SEASONAL NUTRIENT AND SODIUM ACCUMULATION IN THE MACROPHYTE PONTEDERIA CORDATA,
Carleton Univ., Ottawa (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 2I.
W78-06085

SEEPAGE FROM A TRAPEZOIDAL AND A RECTANGULAR CHANNEL USING VARIATIONAL INEQUALITIES,
California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.
For primary bibliographic entry see Field 4B.
W78-06098

THE INFILTRATION CYLINDER: SOME COMMENTS ON ITS USE,
Dundee Univ. (Scotland). Dept. of Geography.
A. S. Tricker.
Journal of Hydrology, Vol. 36, No. 3/4, p 383-391, February 1978. 5 fig, 3 tab, 10 ref.

Descriptors: *Infiltrometers, *Infiltration, *Laboratory tests, Seepage, Permeability, Soils, Data processing, Regression analysis, Soil science, Soil water, Soil water movement, Cylinder infiltrometets.

Values of infiltration capacity obtained from cylinder infiltrometers are always distorted because of the lateral seepage of water. Recommendations were made as to the best size of cylinder to achieve reasonable accuracy with a small demand for water supply. Laboratory experiments were described also, from which an equation to correct measured infiltration capacities for lateral seepage was derived and tested. (Sims-ISWS)
W78-06103

PACKING AND ANGLE OF REPOSE OF NATURALLY SEDIMENTED FINE SILICA SOLIDS IMMERSED IN NATURAL AQUEOUS ELECTROLYTES,
Imperial Coll. of Science and Technology London (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W78-06106

FACTORS INFLUENCING THE CRUST TEST FOR IN SITU MEASUREMENT OF HYDRAULIC CONDUCTIVITY,
Wisconsin Univ.-Madison. Dept. of Soil Science.
F. G. Baker.
Soil Science Society of America Journal, Vol. 41, No. 6, p 1029-1032, November-December 1977. 1 fig, 5 tab, 14 ref. EPA R802874.

Descriptors: *Hydraulic conductivity, *Permeability, *On-site investigations, Soil water, Soil water movement, Soils, Soil properties, Soil physics, Soil physical properties, Testing, Testing procedures, Soil science, Crust tests.

Field trials using the crust test were used to determine the influence of five parameters on the saturated and unsaturated hydraulic conductivity values measured on two soils of different structure. These factors were: (1) the diameter, (2) the height of the soil pedestal used in the test, (3) the degree of soil wetness at which k was measured, (4) soil structure, and (5) operator effects. Diameter and height were found to strongly affect measurement when they had low values. These two

design factors were dependent on the wetness and structure of the soil. Operator differences were small. (Sims-ISWS)
W78-06109

SOLUTE DISTRIBUTION PROFILES COMPUTED WITH STEADY-STATE AND TRANSIENT WATER MOVEMENT MODELS,
New Mexico State Univ., University Park. Dept. of Agronomy.
P. J. Wierenga.
Soil Science Society of America Journal, Vol 41, No 6, p 1050-1055, November-December 1977. 8 fig, 23 ref. EPA S-803156.

Descriptors: *Hydraulic conductivity, *Solutes, *Soil water movement, *Model studies, Mathematical models, Moisture content, Pressure head, Fertilizers, Pesticides, Salts, Irrigation, Dispersion, Analytical techniques, Soil water, Soil physics, Soil science, Miscible displacement, Finite difference analysis.

A comparison was made between two numerical models for simultaneous movement of water and salts in soil profiles. In the first model, the water content and flux were constant during irrigation with time or depth (steady-state model). In the second model, the water contents and fluxes changed with time and depth following each infiltration according to the hydraulic properties of the soil (transient model). From a comparison between data obtained with the two models, it was shown that both techniques yield comparable results when concentrations are plotted versus cumulative drainage. Measured effluent concentration distributions from columns periodically irrigated with labeled water also compared well with effluent concentation distributions computed with the steady-state model. (Sims-ISWS)
W78-06110

HIGHWAY OPERATION AND PLANT DAMAGE-DATA APPENDIX (SOIL CHEMISTRY, SALT APPLICATION, OZONE, PRECIPITATION),
California State Dept. of Transportation, Sacramento. Transportation Lab.
For primary bibliographic entry see Field 4C.
W78-06131

THE EFFECT OF THE SPRAY IRRIGATION OF SECONDARY TREATED EFFLUENT ON THE VEGETATION, SOILS AND GROUNDWATER QUALITY IN A NEW JERSEY PINE BARRENS HABITAT,
Rutgers - The State Univ., New Brunswick, NJ.
For primary bibliographic entry see Field 5B.
W78-06135

SEWAGE SLUDGE-SOIL SYSTEMS: A STUDY OF METAL FORMS AND EFFECT OF METALS ON CARBON AND NITROGEN TRANSFORMATIONS,
Purdue Univ., Lafayette, IN.
For primary bibliographic entry see Field 5C.
W78-06139

EFFECTS OF ANAEROBICALLY DIGESTED MUNICIPAL SEWAGE SLUDGE APPLICATION ON CHEMICAL PROPERTIES OF SELECTED SOILS WITH EMPHASIS ON DISTRIBUTION OF ZINC AND CADMIUM FORMS,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 5B.
W78-06173

2H. Lakes

PRIMARY PLANKTON PRODUCTION IN LAKE BAIKAL, (IN RUSSIAN),
Akademiya Nauk SSSR, Leningrad. Zoologicheskii Inst.
For primary bibliographic entry see Field 5C.
W78-05709

PLANNING METHODOLOGY FOR ANALYSIS AND MANAGEMENT ON LAKE EUTROPHICATION,
Yale Univ., New Haven, CT. School of Forestry and Environmental Studies.
For primary bibliographic entry see Field 5C.
W78-05715

DYNAMICS OF THE BACTERIOPLANKTON POPULATION IN THE UCHINSKOYE RESERVOIR, (IN RUSSIAN),
Moscow State Univ. (USSR).
For primary bibliographic entry see Field 5C.
W78-05729

THE PRIMARY PRODUCTION OF PHYTOPLANKTON IN EXPERIMENTS ON BIOMONITORING AT THE UCHINSKOYE RESERVOIR, (IN RUSSIAN),
Moscow State Univ. (USSR). Dept. of Hydrobiology.
For primary bibliographic entry see Field 5C.
W78-05733

PERACARIDA FROM LAKE DUSYA (BALTIC SEA BASIN) (IN RUSSIAN),
Akademiya Nauk Litovskoi SSR, Vinius. Inst. Zoologii i Parazitologii.
For primary bibliographic entry see Field 5C.
W78-05737

SOME TABLES AND REMARKS CONCERNING THE PELAGIC CRUSTACEAN-ASSOCIATION OF LAKE CONSTANCE 1952-1962, (IN GERMAN),
Staatliches Inst. fuer Seenforschung und Seenbewirtschaftung, Konstanz (West Germany). Abt. Max Auerbach-Inst.
For primary bibliographic entry see Field 5C.
W78-05747

REMOTE SENSING OF LAND USE AND WATER QUALITY RELATIONSHIPS-WISCONSIN SHORE, LAKE MICHIGAN,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 5A.
W78-05749

GREAT LAKES FISH EGG AND LARVAE IDENTIFICATION: PROCEEDINGS OF A WORKSHOP, APRIL 19-21, 1976, ANN ARBOR, MICHIGAN.
National Power Plant Team, Ann Arbor, MI.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 772, Price codes: A11 in paper copy, A01 in microfiche. Report FWS/OBS, 1976. 220 p, 4 append. Edited by J. Boreman.

Descriptors: *Great Lakes, *Fish eggs, *Larvae, *Bibliographies, Fish, Growth stages, Classification, *Fish taxonomy, Reviews, Faunal lists, Distribution, Abundance, Methodology, Analytical techniques, Spawning, Life history studies, Morphology, Terminology, Basic data collections.

A workshop on identifying Great Lakes fish eggs and larvae was sponsored April 19-21, 1976 in Ann Arbor, Michigan by the National Power Plant Team of the U.S. Fish and Wildlife Service. Six workshop papers include: (1) the current level of published taxonomic information, including a 377-entry annotated bibliography and a summary table showing gaps in the literature; (2) complete fish species checklists for the five Great Lakes, with an indication of abundance and commercial, sport, and forage importance; (3) an illustrated identification key to the eggs and larvae of the 26 families of fish in the Great Lakes; (4) research problems of fish egg and larvae studies; (5) proposed terminology system for larval fish phases; and (6) detailed descriptions of the larvae of seven fish species common to southeastern Lake Michigan, with notes on relative abundance, egg size, and spawning periods. Four working group reports deal with; (1) determination of taxonomic information gaps of highest priority; (2) current and potential identification tools; (3) relative value of characteristics used for identification, and their variability in the literature; and (4) identification of a reference collection, with recommendations for a coordination center for the Great Lakes. (See W78-05754 thru W78-05758) (Lynch-Wisconsin)
W78-05753

CURRENT LEVEL OF TAXONOMIC INFORMATION ON GREAT LAKES FISH EGGS AND LARVAE,
State Univ. of New York at Syracuse. Dept. of Forest Zoology.
R. G. Werner.
In: Great Lakes Fish Egg and Larvae Identification: Proceedings of a Workshop, April 19-21, 1976, Ann Arbor, Michigan, P. 6-18. 1 tab, 2 ref.

Descriptors: *Fish eggs, *Great Lakes, *Larvae, *Fish taxonomy, *Bibliographies, Reviews, Fish, Growth stages, Classification, Basic data collections.

A 377-entry annoateted bibliography of literature relevant to fish eggs and larvae of the Great Lakes is presented, and gaps in the literature indicated. There are descriptions of egg and larval stages for only about 34% of Great Lakes fish species while an additional 28% have only one of the two stages described; the remaining 38% have no description. Of existing descriptions many are incomplete, and may not be comparable among species. Although an unidentified specimen may appear to match a description, lack of descriptions for closely-related species makes positive identification impossible. A two-step solution of the problem is: (1) compile descriptive material from the literature as a short-term identification aid to the field investigator, and (2) establish a long-term program to encourage comprehensive investigations into limited tasonomic groups. When sufficient additional research has been completted, an identification dye can be developed. Descriptions should be standardized to enable comparison of species. In addition to the extensive bibliograhy, a summary table arranged by species in included listing references for eggs and larvae descriptions. The bibliography itself is arranged taxonomically, and is considered relatively complete by the author. (See also W78-05753), (Lynch-Wisconsin)
W78-05754

FISH INHABITING U.S. WATERS OF THE GREAT LAKES, WITH INDICATIONS OF THEIR RELATIVE ABUNDANCE AND OF THEIR IMPORTANCE AS COMMERCIAL, SPORT, OR FORAGE SPECIES,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
L. Emery.
In: Great Lakes Fish Egg and Larvae Identification: Proceedings of a Workshop, April 19-21, 1976, Ann Arbor, Michigan, p. 19-25. 9 ref.

Descriptors: *Fish, *Great Lakes, *Faunal lists, *Abundance, United States, Animal populations, Lake Michigan, Lake Superior, Lake Huron, Lake Erie, Lake Ontario, Distribution, Forage fish, Commercial fish, Sport fish.

A literature survey was used to construct complete checklists of fish species for each of the Great Lakes, presented in an appendix to this report. Each species' abundance was classified as: (1) common: (2) uncommon, although formerly common; or (3) uncommon, past and present. Species which have not been recorded in the last ten years were excluded from the lists. A species was classified as common if it occurs in any substantial portion of the lake; included as all fish of commercial importance and most of those important as sport or forage fish. Category 3 fish are generally only marginal inhabitants, residing primarily in tributaries. Fish species important as commercial, sport, or forage fish were do designated. A commercially important fish was defined as one with a production of at least 5,000 lbs in 1974. Only common names are given for the fish. (See also W78-05753) (Lynch-Wisconsin)
W78-05755

FISH EGG AND LARVAE STUDIES: SOME PROBLEMS AND RECOMMENDED SOLUTIONS,
Maryland Univ., Solomons. Chesapeake Biological Lab.
J. D. Hardy, Jr.
In: Great Lakes Fish Egg and Larvae Identification: Proceedings of a Workshop, April 19-21, 1976, Ann Arbor, Michigan, p. 32-40.

Descriptors: *Fish eggs, *Larvae, *Methodology, Analytical techniques, *Research equipment, Reviews, Growth stages, Laboratory equipment, Spawning, Fish, Life history studies, Publications, Preservation, Illustration techniques, Specimen collections.

Difficulties encountered by researchers studying fish eggs and larvae are discussed, including; (1) library research, (2) rearing of fish eggs and larvae, (3) maintaining a specimen collection, and (4) publication. Eight problems involved with bibliographic research are defined: missed references, errors introduced by reviewers, information gaps in reviews, misquoted data, misidentifications, misuse of the term 'life history,' misleading titles, and changes in life history terminology. For egg and larvae rearing, a brief description is given of a circular constant flow embryological module, consisting of a wading pool with a trash can in the middle, a pump, and some water. A mobile unit is being developed. Fish eggs have traditionally been preserved in buffered formalin, but other fixatives are preferred for certain purposes. For illustrations using electron scanning, eggs should be preserved in gluteraldehyde, and for electrophoresis, 2-phenoxyethanol is suggested. More use should be made of color in illustrating. A microscope should become a standard field tool for pigment observations prior to preservation of larvae specimens. Larvae should be preserved in 2-phenoxyethanol; electrophoresis, clearing, and staining are useful for identification. Despite the value of preservation, live eggs are nevertheless preferable for study. In publishing, a loose-leaf format should be considered. (See also W78-05753) (Lynch-Wisconsin)
W78-05756

TERMINOLOGIES FOR INTERVALS OF LARVAL FISH DEVELOPMENT,
Colorado State Univ., Fort Collins. Dept. of Fishery and Wildlife Biology.
D. E. Snyder.
In: Great Lakes Fish Egg and Larvae Identification: Proceedings of a Workshop, April 19-21, 1976, Ann Arbor, Michigan, p. 41-60. 1 fig, 1 tab, 41 ref.

Descriptors: *Larvae, *Fish, *Growth stages, *Life History studies, *Terminology, Analytical techniques, Methodology, Morphogenesis, Fins, Animal growth, Morphology.

Several terminology systems for larval fish phases are reviewed, and a new standardized system is recommended, based on four phases: (1) larva, (2) protolarva, (3) mesolarva, and (4) metalarva. The phases are based on the morphogenesis of the median finfold and fin elements (spines, and rays); paired fins are included in the definition of the last phase. The larval phase is characterized by obvious fin morphogenesis following hatching or parturtion, ending immediately before: (1) the last finfold and atrophying fins are adsorbed beyond recognition; (2) the full complement of distinct fin elements (spines and rays) become apparent in all fins; and (3) principal ray segmentation becomes apparent in all fins. This phase may be absent in some fish. In the protolarval phase distinct median fin elements (dorsal, anal, or caudal spines or rays) are not yet apparent. In the mesolarval phase at least one but not the full complement is present and the adult possesses pelvic fins, the pelvic buds or fins are not yet apparent. The metalarval phase is characterized by the presence of the full complement of distict principal rays in the median fins and, if the adult possesses pelvic fins, the pelvic buds or fins are apparent. Thirteen terminology systems are reviewed in this paper, and a term frequency table is given. (See also W78-05753) (Lynch-Wisconsin)
W78-05757

IDENTIFICATION OF LARVAL FISHES TAKEN FROM THE INSHORE WATERS OF SOUTHEASTERN LAKE MICHIGAN NEAR THE DONALD C. COOK NUCLEAR PLANT, 1973-1975,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
J. A. Dorr, III, D. J. Jude, F. J. Tesar, and N. J. Thurber.
In: Great Lakes Fish Egg and Larvae Identification: Proceedings of a Workshop, April 19-21, 1976, Ann Arbor, Michigan, p 61-82. 3 fig, 8 tab, 14 ref.

Descriptors: *Fish, *Larvae, *Lake Michigan, *Nuclear powerplants, Entrainment, Fish eggs, Spawning, Great Lakes, Nearshore zones, Michigan, Species composition, Sampling, Alewife, Spottail shiner, Rainbow smelt, Yellow perch, Trout-perch, Jonny darter, Slimy sculpin, Basic data collections.

Characteristics of the larvae of seven fish species common to southeastern Lake Michigan are described as an aid to identification. Larvae described are: alewife (Alosa pseudoharengus), spottail shiner (Notropis hydsonius), rainbow smelt (Osmerus mordax), yellow perch (Perch flavescens), trout-perch (Percopsis omiscomaycus), Johnny darter (Etheostoma nigrum), and slimy sculpin (Cottus cognatus). Bloaters and white suckers are found, but spawn outside the study area. About 2000 specimens were collected between 1973-75 at open lake stations and intake/discharge forebays of the Donald C. Cook Nuclear Plant near Bridgman, Michigan. As many as 20 million eggs are calculated to have been entrained by the plant in a single day. Larval samples were collected with a 361-micrometer mesh plankton net, concentrated in 0.5-liter jars, and preserved in 10% formalin. Larval identification was made using abundance/distribution information for adult fish, identification keys and descriptive literature, comparison with known specimens, rearing of larvae, and assistance from outside investigators. Adult fish sampling was conducted concurrently. Alewife constituted 73% by number of the adult fish catch, and 72% of the larval catch, followed by spottail shiners (15%, 21%), rainbow smelt (7%, 5%), yellow perch (3%, 2%), trout-perch (2%, 0.2%), Johnny darter (0.2%, 0.1%), and slimy sculpin (0.1%, 0.1%). Spawning period and egg size charts are included. (See also W78-05753) (Lynch-Wisconsin)
W78-05758

OBSERVATIONS OF LONG NONLINEAR INTERNAL WAVES IN A LAKE,
Department of the Environment, Victoria (British Columbia). Inst. of Ocean Sciences.
D. M. Farmer.
Journal of Physical Oceanography, Vol 8, No 1, p 63-73, January 1978. 11 fig, 1 tab, 20 ref.

Descriptors: *Internal waves, *Lakes, *On-site investigations, *Canada, Temperature, Water temperature, Instrumentation, Winds, Waves(Water), Storm surge, Surges, Currents(Water), Current meters, Data collections, Data processing, Limnology, *Babine Lake(British Columbia).

Described in this paper were observations of large-amplitude, long internal waves in Babine Lake, British Columbia. A unique feature of the observations is that they were taken simultaneously at several different points along the major axis, which permits study of the formation and subsequent development of individual waves as they travel along the lake. The waves typically begin as depressions on the thermocline at the south end following strong westerly winds directed along the lake's major axis. A bend in the southern part of the lake, together with the influence of surrounding mountains, can introduce a divergence in the longitudinal component of the wind stress, which in turn produces a thermocline elevation. These two effects then combine to form a northward traveling surge. Subsequent modification of the waveform was interpreted in terms of nonlinear steepening and dispersion. (Sims-ISWS)
W78-05771

REMOTE DETERMINATION OF THE CONCENTRATION OF SUSPENDED PARTICLES IN THE WATER OF RESERVOIRS ON THE BASIS OF MEASUREMENTS OF SPECTRAL LUMINANCE COEFFICIENTS,
L. V. Semenchenko, L. V. Bakhareva, and A. G. Kal'ko.
Soviet Hydrology: Selected Papers, Vol 15, No 1, p 12-14, 1976. 3 fig, 1 tab, 6 ref. Translated from Transactions of the State Hydrologic Institute (Trudy GGI), No 237, p 65-70, 1976.

Descriptors: *Suspended solids, *Remote sensing, *Reservoirs, *Optical properties, Reflectance, Laboratory tests, Measurements, Silts, Sands, Spatial distribution, Distribution patterns, Analytical techniques, Instrumentation, Water quality, Foreign research, Pollutant identification, *USSR.

Simultaneous measurements of the concentration of suspended particles in water and of the spectral luminance coefficients were performed in 1966-69 in three reservoirs: Kayrakkum, Dubossary, and Mingechaur. These reservoirs have a different hydrologic regime and a different composition of suspended matter. Fine fractions typically predominate in the suspended matter, and its reflectivity in the Kayrakkum Reservoir is higher by a factor of 3 than that in the Dubossary Reservoir and by a factor of 2 than in the Mingechaur Reservoir. The suspended particle concentration in the water varied within broad limits, from 2 to 800 g/cum. The relative error in its determination was 15-20%. The depth of visibility of a white disk varied from 4 m to 10 cm. The coefficients of spectral luminance of the reservoirs were measured with an IFT-19 hydrophotometer. Correlation equations obtained can be used for remote determination of the suspended particle concentration in reservoirs from the measured coefficients of their spectral luminance. (Humphreys-ISWS)
W78-05790

CHEMICAL SYSTEMS MONROE RESERVOIR, INDIANA,
Indiana Univ., Bloomington. Dept. of Geology.
M. J. Graham.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 634, Price codes: A07 in paper copy, A01 in microfiche.

Masters of Arts Thesis, August, 1977. 131 p, 23 fig, 3 tab, 21 ref, 2 append. OWRT B-074-IND(3), 14-31-0001-5143.

Descriptors: *Chemical analysis, *Discharge measurement, *Dissolved solids, *Discharged(Water), *Indiana, *Stratification, Ion transport, Ions, Reservoirs, Streams, Streamflow, Turnovers, Chemical stratification, Dry seasons, Wet seasons, Input streams, Flushing, Dissolved solids concentration, Ion concentration, *Monroe Reservoir(IND), Salt Creek, Stephens Creek.

The chemical nature of the input streams (the North, Middle and South Forks of Salt Creek and Stephens Creek) to Monroe Reservoir was analyzed; the input flow was measured at four stream gauging stations. Samples were collected at different flow regimes and analyzed for temperature, pH, conductivity, dissolved oxygen, alkalinity, hardness, turbidity, suspended sediment, Cl(-), PO4(---), SO4(--), NO3(-), Ca(++), Mg(++), K(+), and total Fe. Of the 3 forks of Salt Creek, there are no significant differences between the North and South Forks in mean chemical concentrations. The Middle Fork is higher in Mg(++), and SO4(--) and lower in Cl(-) than the other forks. There is no difference between the major inputs in terms of mean nutrient concentration (phosphate and nitrate). Major cations and bicarbonates decrease with increasing discharge; nitrates, sulphates, and chlorides are not related to discharge. Phosphate and suspended sediment increase exponentially with discharge; by controlling sediment and phosphate input during periods of high discharge, the overall input of these factors can be greatly reduced. The two primary source basins which discharge into the reservoir are described and differ only in Ca(++) mean concentrations. Wet and dry hydrologic periods, with water replacement times of 4.3 months and 21.3 months respectively, were studied. The dry season is characterized by low input flow and lake stage, high concentrations of total dissolved solids and ions, little exchange of water through the reservoir, and water stratification lasting for about one-third of the year. The wet season begins after turnover and a large input of water with low total dissolved solids enters the reservoir. The chemical system may be flushied during the short replacement time of 4.3 months for the wet season. (Seip-IPA)
W78-05805

SEDIMENTATION AND SOIL ALTERATION, MONROE RESERVOIR, INDIANA,
Indiana Univ., Bloomington. Dept. of Geology.
For primary bibliographic entry see Field 2J.
W78-05815

OPTIMAL STATE ANALYSIS OF RESERVOIRS,
California Univ., Riverside. Dry Lands Research Inst.
For primary bibliographic entry see Field 4A.
W78-05817

DIURNAL TEMPERATURE DISTRIBUTION IN SMALL WATER RESERVOIRS (PHASE II),
Missouri Water Resources Research Center.
B. F. Armaly, and D. Prouty.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 587, Price codes: A07 in paper copy, A01 in microfiche. Completion Report, October 10, 1976. 139 p, 20 fig, 59 ref, 3 append. OWRT A-080-MO(4), 14-31-0001-4025 and 6026.

Descriptors: *Stratification, *Thermocline, *Temperature distribution, Solar load, Epilimnion, *Reservoirs, Diurnal, *Turbidity, Impoundments, *Solar radiation, Convection, *Evaporation, Model studies, *Simulation analysis, *Mathematical models, Water temperature, *Ambient conditions, *Computer programs.

The influence of turbidity on the diurnal temperature distribution and thermocline development in a deep water impoundment which is exposed to heating and cooling loads by convection, evaporation, and radiation is examined. The diurnal behavior of the solar load, directional and spectral, is used with an isotropic multiple scattering model to simulate the attenuation of solar flux by turbid water. The diurnal behavior of the ambient temperature, humidity and wind speed were mathematically modeled to simulate the local spring time of the year. The combined conduction and radiation energy transfer through the water was treated as a one dimensional problem and the governing energy equation was numerically solved through an explicit finite difference method. The resulting temperature distribution is significantly affected by the turbidity level of the water and the behavior is similar to the natural temperature distribution in water reservoir. The surface temperature, however, appears to be affected more directly by the ambient conditions and not by the turbidity level of the water. (See also W75-04443)
W78-05818

PHYSICAL AND CHEMICAL LIMNOLOGY AND CHLOROPHYLL-A CONTENTS IN THE PHYTOPLANKTON OF A MOUNTAIN LAKE LAKE SANTO PARMENSE, ITALY, (IN ITALIAN),
Parma Univ. (Italy). Lab. di Ecologia.
For primary bibliographic entry see Field 5C.
W78-05820

BIOLOGICAL ACTIVITY OF SODDY-PODZOLIC SOILS UNFLOODED AND FLOODED BY THE WATER OF MOZHAISK RESERVOIR, (IN RUSSIAN),
Moscow State Univ. (USSR). Dept. of Physics; and Moscow State Univ. (USSR). Dept. of Soil Melioration.
For primary bibliographic entry see Field 2G.
W78-05827

PRODUCTIVITY OF ZOOPLANKTON IN DUVANKUL' LAKE IN THE SOUTHERN URALS, (IN RUSSIAN),
Siberian Research Inst. of the Fish Industry, Sverdlovsk (USSR). Ural Div.
For primary bibliographic entry see Field 5C.
W78-05854

CORRELATION OF THE PROCESSES OF SYNTHESIS TO DESTRUCTION OF ORGANIC MATTER IN RELATION TO THE ANNUAL WATER CONTENT IN THE MOZHAISK RESERVOIR, (IN RUSSIAN),
Moscow State Univ. (USSR). Probl. Lab. Interaction Surface Underground Waters.
For primary bibliographic entry see Field 5C.
W78-05874

EFFECTS OF TEMPERATURE FACTORS IN THE ACCUMULATION OF RADIOACTIVE NUCLIDES IN FISH, (IN RUSSIAN),
For primary bibliographic entry see Field 5C.
W78-05891

HYDROGEOLOGY OF THE LAKE METIGOSHE BASIN NORTH DAKOTA AND MANITOBA,
North Dakota Univ., Grand Forks. Dept. of Geology; and Geological Survey, Grand Forks, ND.
For primary bibliographic entry see Field 5B.
W78-05933

THE USE OF SATELLITE IMAGERY FOR LAKE CLASSIFICATION IN WISCONSIN,
Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering.
K. W. Holmquist, and F. L. Scarpace.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 628, Price codes: A03 in paper copy, A01 in microfiche. Wisconsin Water Resources Center, Madison, Technical Report, WIS-WRC-77-08, 1977. 35 p, 9 fig, 2 table, 1 ref, 1 append. OWRT A-062-WIS(1). 14-34-0001-6052, 14-34-0001-5050.

Descriptors: *Lakes, *Eutrophication, *Computer programs, *Remote sensing, *Lake classification, *Trophic level, Time series analysis, Water pollution, *ERTS, *LANDSAT imagery.

A cooperative program between the Wisconsin Department of Natural Resources (DNR) and the University of Wisconsin has resulted in an initial assessment of the trophic status of inland lakes in the State of Wisconsin from LANDSAT data. The feasibility of using both the photographic representation of the LANDSAT imagery as well as the digital representation of the LANDSAT imagery to classify lakes was investigated. It was determined that LANDSAT imagery can be used to predict lake water parameters or trophic classification. Time series data analyses indicated the necessity of a periodic rather than a one-time data extraction process. The best lake classification can be derived from the digital representation of LANDSAT. Accounting for the differences in atmospheric conditions from day to day is an important consideration in the analysis of LANDSAT imagery. A collection of computer programs has been developed to derive lake trophic status from LANDSAT imagery which correlates well with ground calibration. This analysis technique has been a cost-effective method of classifying inland lakes in Wisconsin.
W78-05935

THE WHITE AMUR AS A BIOLOGICAL CONTROL FOR AQUATIC WEEDS IN INDIANA,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 4A.
W78-05936

CRITERIA FOR THE USE OF VERTICAL AVERAGING IN GREAT LAKES DISPERSION MODELS,
Cleveland State Univ., OH. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5B.
W78-05947

POTENTIAL TOXICITY OF TACONITE TAILINGS TO AQUATIC LIFE IN LAKE SUPERIOR,
Reserve Mining Co., Silver Bay, MN.
For primary bibliographic entry see Field 5C.
W78-05954

DIVERSITY AND DISTRIBUTION OF MUSSELS (BIVALVIA: UNIONACEA) IN A EUTROPHIC RESERVOIR, LAKE ASHTABULA, NORTH DAKOTA,
North Dakota Univ., Grand Forks. Dept. of Geology.
For primary bibliographic entry see Field 5C.
W78-05959

THE CYCLE OF HEAVY METALS IN LAKES, (IN GERMAN),
Eidgenoessische Anstalt fuer Wasservorsorgung, Abwasserreinigung und Gewaesserschutz, Kastienbaum (Switzerland). Seenforschungslab.
For primary bibliographic entry see Field 5B.
W78-05962

PHOSPHORUS LOADING AND RESPONSE IN LAKE VANERN NEARSHORE AREAS,
National Swedish Environmental Protection Board, Uppsala.
For primary bibliographic entry see Field 5C.

W78-05966

PRODUCTION OF CHIRONOMUS, PROCLADIUS, AND CHAOBORUS AT DIFFERENT LEVELS OF PHYTOPLANKTON BIOMASS IN LAKE MEMPHREMAGOG, QUEBEC-VERMONT,
McGill Univ., Montreal (Quebec). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W78-05968

NUTRIENT ENRICHMENT AND EUTROPHICATION OF LAKE MICHIGAN,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
For primary bibliographic entry see Field 5C.
W78-05970

ASSESSMENT OF WHITEFISH AND RELATED SPECIES IN LAKES MICHIGAN AND SUPERIOR,
Wisconsin Dept. of Natural Resources, Madison.
J. D. Moore, and B. L. Swanson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-261 022, Price codes: A03 in paper copy, A01 in microfiche. Report to NOAA National Marine Fisheries Service, Washington, D.C., June 1976. 24 p, 2 fig, 23 tab. 3-169-R.

Descriptors: *Fish year class strength, *Whitefish, *Lake Michigan, *Lake Superior, *Commercial fishing, *Fish populations, Coregonus clupeaformis, Fish, Great Lakes, Fisheries, Fishing, Meteorological data, Wisconsin, Fish management, Temperature.

Year class strengths of lake whitefish (Coregonus clupeaformis) were determined for lakes Michigan and Superior, and factors which regulate year class stength and influence survival to maturity were investigated. Whitefish currently is the most valuable commercial fish in Wisconsin waters of the two lakes, but extreme fluctuations in abundance have occurred for reasons not completely understood. Between 1941 and 1974, Lake Superior production ranged from a low of 46,000 lbs in 1965 to a high of 764,000 lbs in 1949; in 1974 production was 212,000 lbs. In Lake Michigan the low was 9,219 lbs in 1958, and the high was 1,806,174 lbs in 1947; in 1974 the figure was 1,174,208 lbs. Assessment of whitefish stocks was conducted through monitoring commercial gill net and pound net fisheries, evaluation of commercial fishermen's catch reports, and catch sampling of pound net catches. For Lake Superior, year class strengths for 1961-75 are available. The year classes 1966, 1970 and 1973 appear to be strong, while 1961, 1962, 1963, 1969, 1971, 1974, and 1975 are weak to moderately weak. In Lake Michigan, two strong year classes were 1968 and 1969. Year class strengths may be based on climatological factors, direct human influences (fishery), and indirect human influences (environmental or fish species alteration). Warm May-August air temperatures appear to correlate with strong year classes for Lake Superior. (Lynch-Wisconsin)
W78-05971

BACTERIAL CONTAMINATION OF LAKE POWELL WATERS: AN ASSESSMENT OF THE PROBLEM,
New Mexico Univ., Albuquerzque. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W78-05972

ENVIRONMENTAL STATUS OF THE LAKE MICHIGAN REGION, VOLUME 4. PHYTOPLANKTON OF LAKE MICHIGAN,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environment Research Lab.
For primary bibliographic entry see Field 5C.
W78-05973

ENVIRONMENTAL STATUS OF THE LAKE MICHIGAN REGION, VOLUME 6. ZOOBENTHOS OF LAKE MICHIGAN,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
For primary bibliographic entry see Field 5C.
W78-05974

ENVIRONMENTAL STATUS OF THE LAKE MICHIGAN REGION, VOLUME 14. BIRDS OF THE LAKE MICHIGAN DRAINAGE BASIN,
Michigan State Univ., East Lansing.
For primary bibliographic entry see Field 5C.
W78-05975

ENVIRONMENTAL STATUS OF THE LAKE MICHIGAN REGION, VOLUME 16. AMPHIBIANS AND REPTILES OF THE LAKE MICHIGAN DRAINAGE BASIN,
Wisconsin Univ.-Madison. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W78-05976

EUTROPHICATION IN VERMONT,
Vermont Dept. of Water Resources, Montpelier. Water Quality Div.
For primary bibliographic entry see Field 5C.
W78-05977

UTILIZATION OF SATELLITE DATA FOR INVENTORYING PRAIRIE PONDS AND LAKES,
Environmental Research Inst. of Michigan, Ann Arbor.
E. A. Work, Jr, and D. S. Gilmer.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-28596, Price codes: A02 in paper copy, A01 in microfiche. Photogrammetric Engineering and Remote Sensing, Vol. 42, No. 5, p 685-694, May 1976. 11 fig, 12 ref. Report NASA-CR-14654. NASA S-70243AG-4.

Descriptors: *Remote sensing, *Satellites(Artificial), *LANDSAT-1, *Lakes, *Ponds, *Wildlife habitats, *Analytical techniques, Migratory birds, Prairies, ERTS-2, Mapping, Waterfowl, Infrared radiation, Wildlife management, North Dakota, Multispectral scanners.

Two techniques based on remote sensing imagery from the LANDSAT-1 (formerly ERTS-1) satellite were used to map open surface water features in glaciated prairies, in support of studies of waterfowl habitat quality of lakes and ponds in east-central North Dakota. The two recognition techniques were: (1) a single waveband thresholding approach, and (2) proportion estimation, a multiple waveband approach. The single waveband technique was simple to implement, and prairie lakes and large ponds were rapidly and accurately recognized. It was used to generate thematic maps and statistical tabulations describing open surface-water conditions; the maps, however, required additional manual interpretation. The proportion estimation technique estimates the fraction of a resolution cell composed of open water, permitting recognition of a greater number of small ponds and providing improved apparent spatial data resolution by a factor of three. Development of an operational system using high-altitude sensors for synoptically characterizing wetland habitat conditions seems possible using a combination of the two techniques. The single waveband method would identify resolution cells composed totally of water, while the more costly proportion estimation technique would delineate only water peripheral to already identified ponds and lakes, and water features smaller than one resolution cell. (Lynch-Wisconsin)
W78-05979

EFFECTS OF SUBMERGED MACROPHYTES ON HELEOPLANKTONIC CLADOCERA,
Rhode Island Univ., Kingston.
For primary bibliographic entry see Field 5C.
W78-05980

UTAH LAKE-JORDAN RIVER BASIN MODELING PROJECT. VOLUME I. SUMMARY REPORT. VOLUME II. APPENDIX.
Environmental Dynamics Inc., Los Angeles, CA.
For primary bibliographic entry see Field 5B.
W78-05983

ABOUT THE EUTROPHICATION PROCESS OF LAKES, (IN HUNGARIAN),
Lajos Kossuth Univ., Debrecen (Hungary). Dept. of Anthropology; and Lajos Kossuth Univ., Debrecen (Hungary). Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W78-06005

NUTRIENT RELEASE FROM ANAROBIC SEDIMENTS,
Limno-Tech Inc., Ann Arbor, MI.
For primary bibliographic entry see Field 5C.
W78-06007

INVESTIGATION OF THE SUSPENDED SOLIDS FROM LAKE CONSTANCE AFFLUENTS, (IN GERMAN),
Staatliches Inst. fuer Seenforschung und Seenbewirtschaftung, Langenargen (West Germany).
For primary bibliographic entry see Field 5B.
W78-06016

ORGANIC MATTER DISTRIBUTION CHARACTERISTICS IN THE SHOAL SEDIMENTS OF THE SELENGA DELTA IN LAKE BAIKAL, (IN RUSSIAN),
Limnologicheskii Inst., Irkutsk (USSR).
For primary bibliographic entry see Field 5B.
W78-06034

MORTALITY OF FISH AND ENVIRONMENTAL CONDITIONS IN LAKE CHAD DURING A PERIOD OF DROUGHT, (IN FRENCH),
Office de la Recherche Scientifique et Technique Outre-Mer, N'Djamena (Chad). Centre (ORSTOM) de N'Djamena.
V. Benech, J. Lemoalle, and J. Quensiere.
Cah Orstrom Ser Hydrobiol 10(2), p 119-130, 1976.

Descriptors: Lake Chad(Chad), Water level fluctuations, Water loss, *Anoxia, Decomposition, *Drought, Environmental effects, *Fish mortality, Lakes, Macrophytes, Turbulence.

During the 1972-74 drought, Lake Chad (Chad) was split into 3 separate basins as a result of the water level decrease. The variations of some chemical and physical parameters are described for the northern basin and for the eastern archipelago at Bol. Mass fish mortalities were observed in both basins. They are associated with water turbulence during the decrease of the water level but anoxia due to macrophyte decomposition is the main cause for mortalities during the annual flood at Bol. Relative catch per unit effort of some species are given. A criteria level, below which mortalities occurred, was determined for both basins.--Copyright 1977, Biological Abstracts, Inc.
W78-06037

SEASONAL ABUNDANCE AND SPATIAL DISTRIBUTION OF LAKE MICHIGAN MACROBENTHOS, 1964-67,
California State Univ., Los Angeles. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W78-06046

FEDERAL LAKE ERIE WATER QUALITY STANDARDS PROPOSALS.
Environmental Protection Agency, Region V, Chicago, IL.
For primary bibliographic entry see Field 5G.
W78-06048

MERCURY CONCENTRATIONS IN FISH IN LAKE OAHE, SOUTH DAKOTA, APRIL 16 TO SEPTEMBER 27, 1972.
Environmental Protection Agency, Denver, CO.
For primary bibliographic entry see Field 5C.
W78-06051

INLAND WETLAND DEFINITIONS,
Connecticut Univ., Storrs. Biological Sciences Groups.
M. W. Lefor, and W. C. Kennard.
University of Connecticut Institute of Water Resources, Report No. 28, November, 1977. 63 p, 4 fig, 39 ref.

Descriptors: *Wetlands, *Northeast U.S., *Connecticut, *Reviews, Marshes, Swamps, Bogs, Freshwater marshes, Administration, Marsh management, Documentation, Classification, *Definitions(Wetlands), *Inland wetlands, *Descriptions(Wetlands).

This multidisciplinary project was designed to study wetland definitions in depth and to develop definitions suitable for widespread use. Reviewed are inland wetland definitions from: geology, hydrogeology, hydrology, pedology, biology, systems ecology, sociology, economics, political science, public health and law. Of these, geology, hydrogeology, hydrology, biology, systems ecology, and economics are discussed in detail and are used in writing a final theoretical (ideal) definition of inland wetlands for the glaciated northeastern United States. A proposed legal definition for Connecticut is also offered with descriptions and explanations of terms. (Steiner-Mass)
W78-06083

A GUIDE TO UNDERSTANDING AND ADMINISTRATING THE MASSACHUSETTS WETLANDS PROTECTION ACT.
Massachusetts Audubon Society, Lincoln.
For primary bibliographic entry see Field 6E.
W78-06084

ALTERNATIVE MANAGEMENT STRATEGIES FOR VIRGINIA'S COASTAL WETLANDS: A PROGRAM OF STUDY,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6G.
W78-06086

THE USE OF WATER AND MINERALS BY EVERGREEN AND DECIDIOUS SHRUBS IN OKEFENOKEE SWAMP,
California Univ., Santa Barbara. Dept. of Biological Sciences.
For primary bibliographic entry see Field 2I.
W78-06087

DISTRIBUTION, SEASONALITY, AND BIOMASS OF AQUATIC MACROPHYTES IN LAKE OPINICON (EASTERN ONTARIO),
Queen's Univ., Kingston (Ontario). Dept. of Biology.
A. A. Crowder, J. M. Bristow, M. R. King, and S. Vanderkloet.
Le Naturaliste Canadien, Vol. 104, p 441-456, 1977. 7 fig, 4 tab, 31 ref, 1 append.

Descriptors: *Submerged plants, *Biomass, *Distribution patterns, *Phenology, Aquatic plants, Rooted aquatic plants, Pondweeds, Aquatic habitats, Lakes, Ecological distribution, Plant growth, *Seasonal, *Canada, *Lake Opinicon(Ontario), *Aquatic macrophytes.

The biomass, frequency, abundance, distribution, and phenology of the submerged macrophytes in the lake were investigated. Mean organic biomass was 248 g per sq m with a range of 1 to 1,154 g per sq m; biomass decreased significantly with depth. The most frequent plants were Chara globularis, Lemna triscula, Vallisneria americana, Potamogeton robbinsii, Potamogeton friesii, Myriophyllum spp., Najas flexilis, Najas guadalupensis and Ceratophyllum demersum, which were all positively associated. N. guadalupensis and C. demersum occurred in deeper water. Time of flowering varied considerably from species to species. A comparison with a 1947 survey showed no major changes (Myriophyllum spicatum has however increased since 1974). A checklist of the macrophytes of both the deep and shallow water is appended. (Steiner-Mass)
W78-06088

FORESTS AND WATER: EFFECTS OF FOREST MANAGEMENT ON FLOODS, SEDIMENTATION, AND WATER SUPPLY,
Pacific Southwest Forest and Range Experiment Station, Berkeley, CA.
For primary bibliographic entry see Field 4C.
W78-06089

WETLAND MAPPING IN NEW JERSEY AND NEW YORK,
Earth Satellite Corp., Washington, DC.
For primary bibliographic entry see Field 7C.
W78-06092

COMPARATIVE CHEMISTRY OF A COOLING RESERVOIR AND ITS WATER SOURCE,
North Texas State Univ., Denton. Dept. of Biological Science.
For primary bibliographic entry see Field 5B.
W78-06114

THE ARRESTED TOPOGRAPHIC WAVE,
Woods Hole Oceanographic Institution, MA.
G. T. Csanady.
Journal of Physical Oceanography, Vol. 8, No. 1, p 47-62, January 1978. 8 fig, 1 tab, 23 ref.

Descriptors: *Circulation, *Water circulation, *Ocean circulation, *Waves(Water), *Model studies, *Lake Ontario, Mathematical models, Winds, Ocean waves, Topography, Shores, Coasts, Oceans, Continental Shelf, Lakes, Oceanography, Limnology, Topographic waves.

The mean circulation in a coastal zone of variable depth, under certain circumstances, may be modeled by linear equations, including a bottom friction linear in the depth-averaged velocity. The resulting steady-state problem is similar to the problem of topographic wave generation by wind. The equation governing the pressure field has the form of a one-dimensional heat conduction equation, with longshore distance in the direction of topographic wave propagation playing the role of time. The effects of wind stress or of freshwater influx are felt only over the forward portion of a long shelf (i.e., that portion to which topographic waves propagate from the source region). Various simple solutions can be written down for the arrested topographic wave problem in virtue of the heat conduction analogy. Generally the solutions show the presence of a pressure field trapped in a nearshore band. For periodic wind stess, for example, the scale width of the trapped pressure field is L = sq rt of (2r/fks), where r is a bottom resistance coefficient (dimension velocity), f the Coriolis parameter, k the longshore wavenumber of the wind stress, and s bottom slope, assumed constant. The model was applied to the eastern North Ameican continental shelf in an attempt to determine the physical origin of the southwestward pressure gradient which has recently been identified as the main driving force of the observed longshore flow. It was shown that neither wind stress nor freshwater influx can be held reasonably accountable for this pressure gradient. On the other hand, a longshore surface elevation gradient imposed at the shelf break by the dynamics of a deepwater current produces exactly the type of response observed over the shelf. The same model also accounts for the mean circulation in winter of Lake Ontario, as well as for some features of the summer circulation. (Sims-ISWS)
W78-06117

AN ECOLOGICAL MODEL FOR LAKE ONTARIO MODEL FORMULATION, CALIBRATION, AND PRELIMINARY EVALUATION,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
D. Scavia, B. J. Eadie, and A. Robertson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 412, Price codes: A04 in paper copy, A01 in microfiche. NOAA Technical Report ERL 371-GLERL 12, June 1976. 68 p, 23 fig, 5 tab, 92 ref, 3 append.

Descriptors: *Ecology, *Great Lakes, *Lake Ontario, *Model studies, Mathematical models, Phytoplankton, Zooplankton, Detritus, Nitrogen, Ammonia, Nitrates, Phosphorus, Carbonates, Benthos, Benthic fauna, Fish, Lakes, Limnology, Biological properties.

A simulation model was developed for the Lake Ontario ecosystem. The model described the dynamics of four types of phytoplankton and six types of zooplankton, detritus, organic nitrogen, ammonia, nitrate, available phosphorus, the carbonate system, and benthic invertebrates. The equations were described. The ecological model was driven by a physical model designed to predict average temperature, segment thicknesses, and vertical diffusion coefficients for the three-layer model. In addition, an original formulation for calculating sedimentation rates was shown to predict accurately community settling rates. The simulated processes and predicted variables follow ecologically realistic patterns and compare favorably to measured parameters in Lake Ontario. Sensitivity analyses revealed that modeled phosphorus was quite responsive to changes in diffusion, sedimentation was critical to predicting benthic dynamics, and self-shading by phytoplankton was not critical due to the relationship between light limitation and phosphorus depletion. Changes in temperature resulted in predicted shifts in the peaks of the phytoplankton and zooplankton, and the sensitivity of the model to fish predation indicated the need for better descriptions of fish dynamics. (Sims-ISWS)
W78-06119

REVIEW AND APPRAISAL OF NUMERICAL CIRCULATION MODELS FOR LAKE MICHIGAN,
Argonne National Lab., IL. Energy and Environmental Systems Div.
J. H. Allender.
Available from the National Technical Information Service, Springfield, VA 22161 as ANL/WP-76-6. Price codes: A06 in paper copy, A01 in microfiche. Report ANL/WR-76-6, September 1976. 111 p, 40 fig, 4 tab, 68 ref, 1 append. ERDA W-31-109-Eng-38.

Descriptors: *Lake Michigan, *Great Lakes, *Water circulation, *Model studies, Mathematical models, Currents(Water), Winds, Lakes, Numerical analysis, Theoretical analysis, Mathematics, Bathymetry, Meteorological data, Current meters, Limnology.

Output from four numerical-hydrodynamical models for the lake was compared to data from the field program of the Federal Water Pollution Control Agency (FWPCA) for September 1963 and/or to other limited data from which lake currents could be inferred. The comparisons between model-generated and observed currents were made by using real-time graphs for fixed locations, power spectra, lakewide plots of average motion, progressive vector diagrams, cumulative scalar- and vector-averaged currents at fixed locations; horizontal scalar averages at various depths; and Fourier norms. The major merit of the models was their apparent ability to simulate circulation patterns. This ability can be used to expose important avenues of exchange between the northern and southern basins of the lake and to locate dominant features in the motion of the lake. The major failing of the models was their inability to simulate time-series currents at a fixed location. This failing was shown to be primarily the result of inadequate knowledge of wind and temperature fields. Choice of an appropriate means for data and model comparison evolves as a difficult and important task. Suggestions were made for model improvement and synthesis with future observations in order to focus on average motion in the deep lake. (Sims-ISWS)
W78-06122

WATER RESOURCES RESEARCH PROGRAM, NEARSHORE CURRENTS AT POINT BEACH, WISCONSIN (1974-1975),
Argonne National Lab., IL. Energy and Environmental Systems Div.
K. D. Saunders, L. VanLoon, C. Tome, and W. Harrison.
Available from the National Technical Information Service, Springfield, VA 22161 as ANL/WR-76-1, Price codes: A12 in paper copy, A01 in microfiche. Report ANL/WR-76-1, March 1976. 270 p, 198 fig, 10 tab, 23 ref, 3 append. ERDA W-31-109-Eng-38.

Descriptors: *Currents(Water), *Lake Michigan, *Wisconsin, *Surveys, *Great Lakes, Winds, Instrumentation, Equipment, Current meters, Circulation, Water circulation, Lakes, On-site investigations, Data processing, Analytical techniques, Powerplants, Shores, Limnology, Meteorology, *Point Beach(Wis), *Nearshore currents.

Coastal currents were monitored at stations 0.4, 1.1, and 3.8 km from shore along a coast-perpendicular transect located 1 km south of the Wisconsin Electric Power Company's nuclear generating station. Complete specifications were given for current meter calibrations, electronics used, winter and summer mooring configurations, and for the performance of each meter and mooring assembly. Local winds were monitored at the power plant intake using a mechanical, MRI wind system. The following types of graphs were presented for current and wind observations: (1) U, V flow components versus time, (2) specific kinetic energy versus time, (3) flow speeds and directions versus time, (4) composite velocity histograms and associated U, V-component histograms, and (5) progressive vector diagrams. A linear, optimal-filter design technique (Wiener filter) was used to estimate the efficiency of wind-driven, linear, nearshore current-prediction models. The poor predictions of the models probably relate to such factors as lack of input for superimposed lake currents, time-base errors, and wind-stress formulas. (Sims-ISWS)
W78-06123

I. DYNAMICS OF MERCURY IN LAKE SEDIMENTS. II. STUDIES ON ORGANIC PHOSPHORUS IN SOILS IRRIGATED WITH MUNICIPAL WASTEWATERS,
Purdue Univ., Lafayette, IN.
For primary bibliographic entry see Field 5C.
W78-06137

AERATION/CIRCULATION KEEPS ALGAL BLOOMS IN CHECK,
Tetra Tech, Inc., Lafayette, CA.
For primary bibliographic entry see Field 5G.
W78-06140

DISSOLVED ORGANIC MATTER AND LAKE METABOLISM,
Michigan State Univ., Hickory Corners. W. K. Kellogg Gull Lake Labs.
For primary bibliographic entry see Field 5C.
W78-06142

BENTHOS OF AN ACID LAKE,
Uppsala Univ. (Sweden). Dept. of Entomology.
For primary bibliographic entry see Field 5C.
W78-06154

MAINTENANCE OF A TROUT FISHERY BY AERATION IN A EUTROPHIC LAKE,
Adelphi Univ., Oakdale, NY. Inst. of Marine Science; and Adelphi Univ., Garden City, NY.
For primary bibliographic entry see Field 5G.
W78-06171

SEDIMENTATION IN SANTA MARGARITA LAKE, SAN LUIS OBISPO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2J.
W78-06182

PALEOGEOCHEMISTRY AND INTERSTITIAL WATER CHEMISTRY FROM SEDIMENTS OF FIVE MAINE LAKES,
Maine Univ. at Orono. Dept. of Geological Sciences.
D. R. Sasseville, and S. A. Norton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 799, Price codes: A03 in paper copy, A01 in microfiche. Completion Report (1976). 42 p, 11 fig, 4 tab, 18 ref. OWRT A-026-ME(5).

Descriptors: *Connate water, *Water chemistry, *Sediments, *Maine, Lakes, Watershed management, Trophic level, Geochemistry, Limnology, *Lake sediments, *Pollutant identification, Eutrophication, *Annabessacook Lake(ME), Paleogeochemistry.

Paleochemistry and interstitial water investigated by analyzing undisturbed cores of profundal sediments collected from five noncalcareous lakes in Maine. K20, Na20, MgO, and Al203 normally increase in concentration in the cultural sediments, indicating erosion of unweathered aluminosilicate minerals from watershed soils. Marked increases in concentration of P, S, and organic matter in the sediments of Annabessacook Lake confirmed that the lake is culturally eutrophic. The lakes exhibited much individually in concentrations and trends of their sediments. Interstitial chemistry profiles and upper sediment composition appeared controlled by diffusion and diagenesis. Significant contributions of components, especially Fe, Mn, P, and Si, to the overlying waters resulted from upward diffusion of dissolved species. The upper zone of lake sediment was identified as a region of substantial chemical reactions involving especially Si, Fe, Mn, P, and other redox-sensitive elements. Near-surface reactive layers with greater than normal concentrations of various dissolved species were present in most of the cores. General levels of K, Na, Ca, Mg, and Si in the interstitial water were not directly related to bulk chemistry of the solid sediment. The conclusion was that interstitial water concentrations in sediment are more affected by sediment character and composition than by the lake's trophic conditions or degree of cultural development. (Wares-IPA)
W78-06199

A TWO DIMENSIONAL LAKE CIRCULATION MODEL USING THE METHODS OF FINITE ELEMENTS,
Massachusetts Univ., Amherst. Water Resources Research Center.
P. A. Mangarella.
Research Report, June, 1976, 35 p, 1 fig, 25 ref. OWRT A-061-MASS(1), WR-61 FY-74.

Descriptors: *Stratification, *Lakes, *Wind velocity, *Thermal stratification, *Finite element analysis, *Mathematical models, Computer models, Mathematical studies, Currents(Water), Water circulation, Analytical methods, *Finite element method.

A mathematical model is applied in the analysis of the currents system and thermal stratification created by the interaction of the wind with a stratified lake. The steady and unsteady responses (in terms of current magnitude and direction, temperature, and free surface location) to varying wind regimes, initial stratification, and lake geometry are examined. A two-dimensional vertical plane solution for continuity, incompressibility, and momentum equations of flow and for the convective diffusion equation for temperature is proposed using the Finite Element Method. The model takes into consideration the effects of stratification and turbulence through an eddy viscosity model in which the eddy viscosities are assumed to be constant in any given direction over any element. Eddy viscosity and eddy diffusion models are used to describe the turbulent transport of momentum and energy (enthalpy), respectively. (Seip-IPA)
W78-06200

2I. Water In Plants

STUDY OF THE PHYSICAL CHARACTERISTICS OF THE ACTIVE HORIZON OF UNDRAINED BOGS (ISSLEDOVANIE FIZICHESKIKH KHARAKTERISTIK DEYATELNOGO GORIZONTA NEOSUSHENNYKH BOLOT),
P. K. Vorob'ev.
Available from the National Technical Information Service, Springfield, Va 22161 as TT-71-51010, Price codes: A03 in paper copy, A01 in microfiche. Translation TT-71-51010, 1974. 43 p. 12 fig, 3 tab, 18 ref, append.

Descriptors: *Bogs, *Sphagnum moss, *Active horizon, *Peat, *Water yield coefficients, Wetlands, Undrained bogs, India, Lammin-Suo bog(India), Hydrology, Hydrologic aspects, Water yield.

In a study of the physical characteristics of undrained sphagnum moss bogs in India, a method is described for determining water yield coefficients from the data of field equipment emplaced to register the reaction of the ground water table to precipitation. Two peat deposit horizons in undrained bogs are customarily distinguished, which differ considerably in relation to hydrological processes and moisture and energy exchanges between bogs and the surrounding area. The lower horizon of an undrained bog is inert, while in the active horizon fluctuations in moisture reserve, water table, precipitation absorption, capillary rise of moisture to the surface, and water filtration occur. Important hydrological and physical components of the active horizon include: (1)

thickness of the layer; (2) slope of bog surface and water table; (3) average depth of the water table; (4) average water flow rate per unit length of the flow front; (5) chemical composition of the water; (6) function for the distribution of the filtration coefficient over active layer depth; and (7) distribution of the water yield coefficients of different layers over the active layer depth. Physical characteristics investigated were: (1) volumetric weight and distribution of dry vegetable matter; (2) peat moisture in the aeration layer; (3) pore surface in sphagnum floss; (4) and water loss in the active horizon. Peat samples were collected in the upland bog, Lammin-Suo (India). (Lynch-Wisconsin)
W78-05760

COMPUTATION OF PRECIPITATION INTERCEPTION BY THE PLANT COVER,
V. V. Golubtsov, and V. I. Li.
Soviet Hydrology: Selected Papers, Vol 15, No 1, p 39-40, 1976. 16 ref. Translated from Transactions of the Kazakh Hydrometeorological Scientific *Research Institute (Trudy KazNIGMI)*, No 48, p 65-69, 1975.

Descriptors: **Interception*, **Throughfall*, *Estimating, Precipitation(Atmospheric), Canopy, Vegetation effects, Rainfall, Snowfall, Forests, Trees, Evaporation, Equations, Hydrology, Foreign research, Foreign countries, *USSR.

Since it is extremely difficult to determine precipitation interception experimentally, it becomes necessary to develop and use computation methods. A proposed computation method determines the accumulation of intercepted water. From the result of verification of the proposed method by means of observational data, it was established that the errors in the determination of the monthly values of interception of liquid and solid precipitation generaly range within + or - 20% and may reach 25-30% in some cases. It was concluded that the proposed method can be used successfully in hydrologic investigations for estimating the dynamics of precipitation interception and for computing throughfall. (Humphreys-ISWS)
W78-05796

RESPONSE OF THE DEVIL'S RIVER (TEXAS) FISH COMMUNITY TO FLOODING,
Baylor Univ., Waco, TX. Dept. of Biology.
H. L. Harrell.
Copeia, 1978, No. 1, February, p 60-68, 3 fig, 2 tab, 27 ref.

Descriptors: *Environmental effects, Floods, Biological communities, Rivers, Fish reproduction, Habitats, Texas, *Devil's River(Tex), Ecosystems, Flood damage, Succession, Biomass.

A description is presented of species associations of dominant fishes in the free-flowing Devil's River, their responses to flooding, and relationships between these changes and total fish community stability. During flooding, habitat distinctness and species diversity declined as did the population of 6 to the 8 subdominant fishes. Most species associations were dissolved and new ones formed. Four of the 6 dominants among Devil's River fishes increased in abundance after flooding. The dominants retained ecologic importance despite pronounced shifts in their use of habitats. It is suggested that, in the comparative measurement of ecosystem stability, continued or increased dominance by a few species be considered typical of naturally stressful environments. (Chilton-ORNL)
W78-05951

PHOTOSYNTHESIS AND SOLAR ENERGY CONVERSION,
Cornell Univ., Ithaca, NY. Div. of Biological Sciences.
For primary bibliographic entry see Field 8C.
W78-05969

A METHOD OF MEASURING AIRBORNE ACIDITY: ITS APPLICATION FOR THE DETERMINING OF ACID CONTENT ON LONG-DISTANCE TRANSPORTED PARTICLES AND IN DRAINAGE WATER FROM SPRUCES,
Swedish Water and Air Pollution Research Lab., Goteborg.
For primary bibliographic entry see Field 5A.
W78-06003

SEASONAL NUTRIENT AND SODIUM ACCUMULATION IN THE MACROPHYTE PONTEDERIA CORDATA,
Carleton Univ., Ottawa (Ontario). Dept. of Biology.
I. L. Bayly, and M. E. Shibley.
Canadian Journal of Botany, Vol. 56, No. 4, p 417-425, 1978. 6 fig, 19 ref.

Descriptors: *Rooted aquatic plants, *Marsh plants, *Seasonal, *Soil-water-plant relationships, *Nutrient requirements, *Plant physiology, Wetlands, Marshes, Aquatic plants, Nutrients, *Cycling nutrients, Plant growth, Soil chemical properties*, Sodium, Phosphorus, Calcium, Magnesium, Potassium, *Pontederia cordata, Aquatic macrophytes.

A seasonal study of the accumulation of calcium, magnesium, sodium, potassium, and phosphorus was made on Pontederia cordata L., an important component of wetlands in North America. Calcium accumulation by the plants increased throughout the growing season. The major accumulation was in the root system, the plant part that overwinters. A marked decline in potassium content was evident at the end of the growing season in all tissues except the rhizomes. A concomitant potassium increase occurred in the soil horizon in which the plants were rooted. Sodium and magnesium were accumulated in all plant parts, although the trends were only moderately significant. Soil magnesium showed a decrease over this same period. Phosphorus accumulation was high at the initial stage of declined throughout the season. (Steiner-Mass)
W78-06085

THE USE OF WATER AND MINERALS BY EVERGREEN AND DECIDIOUS SHRUBS IN OKEFENOKEE SWAMP,
California Univ., Santa Barbara. Dept. of Biological Sciences.
W. H. Schlesinger, and B. F. Chabot.
Botanical Gazette, Vol. 138, No. 4, p 490-497, 1977. 3 fig, 5 tab, 40 ref.

Descriptors: *Swamps, *Moisture uptake, *Shrubs, *Nutrient requirements, Wetlands, Aquatic plants, Consumptive use, Circulation(Plants), Nutrients, *Georgia, *Okefenokee Swamp(Geo), Deciduous shrubs, Evergreen shrubs, Foliar concentrations.

Shoot water potentials, leaf diffusion resistances, and foliar concentrations of Ca(++), Mg(++), K(+), N, and P were measured in an evergreen shrub, Lyonia lucida, and a deciduous shrub, Clethra alnifolia. An upland, evergreen species, Lyonia ferruginea, was included for comparison. C. alnifolia generally had the highest mineral contents (percentage of dry weight) and the highest water loss in transpiration. During several 24-hour monitoring periods, the lowest observed water potentials (L. lucida, --10.1 bars; C. alnifolia, --12.5 bars; L. ferruginea, --17.2 bars) did not suggest 'physiological drought' in the swamp species. Only L. lucida showed any evidence of midday stomatal closure. In this warm-temperate swamp, evergreen species have the potential for greater efficiency of mineral use and productivity, largelty due to their leaf longevity. In addition, sclerophyllous tissue is probably useful in defense against herbivores. (Steiner-Mass)
W78-06087

DISTRIBUTION, SEASONALITY, AND BIOMASS OF AQUATIC MACROPHYTES IN LAKE OPINICON (EASTERN ONTARIO),
Queen's Univ., Kingston (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 2H.
W78-06088

SEASONAL MEASUREMENTS OF CARBON, NITROGEN, ASH, IRON, CARBOHYDRATES, AND PIGMENTS FROM GEOGRAPHICALLY DIFFERENT SPARTINE ALTERNIFLORA MARSHES IN THE SOUTHEAST,
Skidway Inst. of Oceanography, Savannah, GA.
G. L. McIntire, and W. M. Dunstan.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 983, Price codes: A04 in paper copy, A01 in microfiche.
Technical Report Series Number 76-5, Georgia Marine Science Center, University System of Georgia, Skidway Island, Georgia. 20 p, 2 fig, 10 tab, 19 ref. (1976).

Descriptors: *Marshes, *Marsh plants, Period of growth, *Nutrient requirements, *Southeast U.S., Wetlands, Coastal marshes, Salt marshes, Rooted aquatic plants, Halophytes, Grasses, *Seasonal, *Carbon, *Nitrogen, *Carbohydrates, Nutrients, *Ash, *Iron, *Spartina alterniflora.

Average seasonal nitrogen levels for Spartina show higher percentages of nitrogen in the early part of the growing season dropping to relatively constant levels by late spring. Carbon to nitrogen levels for leaves were within the range of terrestrial plants (30-40) which contain a higher percentage of structural carbohydrates. Stem percentages were higher reflecting the accumulation of cellulitic compounds during the year. The carbon:nitrogen values illustrated the generally nitrogen poor status of Spartina. Tissue concentrations of iron dropped from January to July in both leaf and stem samples while percent ash content decreased during the year probably to the time of peak standing crop, increasing thereafter with the death of the plants. Nonstructural carbohydrates (NSC) values for leaves and stems average approximately 45 and 55 mg NSC/dry gram wt respectively through the July samples. Reduced NSC levels occur in late fall which may reflect greater percentages of dead and dying materials within the samples. Temperature and environmental effects on photosynthesis and/or translocation of photosynthetic production may also be responsible for reduced NSC levels in leaf and stem tissues. Pigment concentrations generally decreased from January to October. (Steiner-Mass)
W78-06093

NITROGEN UPTAKE CHARACTERISTICS OF CORN ROOTS AT LOW N CONCENTRATION AS INFLUENCED BY PLANT AGE,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
J. H. Edwards, and S. A. Barber.
Agronomy Journal, Vol 68, No 1, p 17-19, January-February 1976. 1 fig, 2 tab, 9 ref. OWRT B-026-IND(6).

Descriptors: *Nitrogen, *Corn(Field), Fertilizers, Fertilization, Roots, Soil investigations, Greenhouse experiments, *Absorption.

Information is needed on the relation between concentration of N in solution, CN, and the rate of N uptake by corn roots in order to evaluate the soil and crop parameters affecting N fertilizer efficiency. Data on net N influx, In, vs. CN were obtained for N levels below 150 micro M on corn plants of seven ages ranging from 15 to 58 days (2 weeks after tasseling). It was determined by measuring rate of N depletion from the solution in which corn plants grew. Both NH+4 and NO-3 forms of N were used. Th experiments were conducted in the

growth chamber and greenhouse. (See also W76-11519 and W74-05404) (Skogerboe-Colorado State)
W78-06097

INTERCEPTION BY PINUS PATULA IN RELATION TO RAINFALL PARAMETERS,
Natal Univ., Pietermaritzburg (South Africa). Dept. of Agricultural Engineering.
R. E. Schulze, C. R. Scott-Shaw, and U. W. Nanni.
Journal of Hydrology, Vol. 36, No. 3/4, p 393-396, February 1978. 2 fig, 1 tab, 5 ref.

Descriptors: *Rainfall, *Africa, *Interception, *Pine trees, On-site investigations, Forests, Coniferous forests, Coniferous trees, Vegetation, Precipitation(Atmospheric), Canopy, Water loss, Rain, Rainfall intensity, Data processing, Forestry, *South Africa, Pinus patula.

Relationships between gross daily rainfall and interception and between rainfall duration and interception for four categories of rainfall intensity were given for a 10-year old stand of Pinus patula at Cathedral Peak in South Africa. Interception was shown to increase with rainfall intensity for given durations of a storm. (Sims-ISWS)
W78-06104

UPTAKE BY BARLEY OF WATER TABLE- OR SURFACE-APPLIED CADMIUM,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W78-06111

2J. Erosion and Sedimentation

MEASUREMENT OF SEDIMENT CONTROL IMPACTS ON AGRICULTURE,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 5G.
W78-05701

FALLOUT CESIUM-137 IN CULTIVATED AND NONCULTIVATED NORTH CENTRAL UNITED STATES WATERSHEDS,
Agricultural Research Service, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 5B.
W78-05779

EFFECTS OF SOIL, COVER CROP, AND NUTRIENT SOURCE ON AMOUNTS AND FORMS OF PHOSPHORUS MOVEMENT UNDER SIMULATED RAINFALL CONDITIONS,
Ohio Agricultural Research and Development Center, Wooster.
For primary bibliographic entry see Field 5B.
W78-05780

AQUEOUS- AND SEDIMENT-PHASE PHOSPHORUS YIELDS FROM FIVE SOUTHERN PINE WATERSHEDS,
Southern Forest Experiment Station, Oxford, MS.
For primary bibliographic entry see Field 5B.
W78-05781

STATISTICAL EVALUATION OF RAINFALL-SIMULATOR AND EROSION TESTING PROCEDURE,
Louisiana Dept. of Highways, Baton Rouge. Research and Development Section.
S. M. Law.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 469. Price codes: A03 in paper copy, A01 in microfiche. Research Report 106, January 1977. 43 p, 6 fig, 4 tab, 11 ref, 1 append.

Descriptors: *Rainfall simulators, *Statistics, *Erosion, Statistical methods, Soils, Hydrology, Laboratory tests, Instrumentation, Testing procedures, Mulching, Stabilization, *Soil loss, Statistical repeatability.

Much money, time, and work are expended each year in evaluating new erosion products. Test locations in the field are now hard to find; therefore, a better method of first checking erosion products had to be found. A tentative laboratory test procedure had been developed by which these products could be evaluated. A rainfall-simulator had been designed and operated using this test procedure; however, complete testing for statistical purposes had not been accomplished. The specific aims of the study were: (1) to supply documentation of statistical repeatability of the rainfall-simulator and the soil-loss data using the test procedure, (2) to reevaluate the design and operation of the rainfall-simulator, and (3) to reevaluate the test procedure. These aims were carried out in a series of repetitive tests. Principal conclusions were as follows: (1) the revised rainfall-simulator was capable of statistically repeatable operation, (2) use of the revised tentative laboratory test procedure was justified, (3) revisions were necessary in the original design and operation of the rainfall-simulator, and (4) revisions were necessary in the original tentative laboratory test procedure. Principal recommendations were: (1) that the research study statistical data be accepted as documentation of completion of specific aims of the study, and (2) that the construction of the rainfall-simulator be accepted as a necessary tool in performance of laboratory testing of new products in the erosion field through the use of the revised tentative laboratory test procedure. (Lee-ISWS)
W78-05785

ORGANIC MATTER IN THE SUSPENDED LOAD OF THE RIVERS AND IRRIGATION SYSTEMS OF SOVIET CENTRAL ASIA,
For primary bibliographic entry see Field 5B.
W78-05799

SEDIMENTATION AND SOIL ALTERATION, MONROE RESERVOIR, INDIANA,
Indiana Univ., Bloomington. Dept. of Geology.
K. R. Bradbury.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 553, Price codes: A05 in paper copy, A01 in microfiche. Report, Master of Arts, Thesis, April, 1977. 83 p, 21 fig, 11 tab, 31 ref, 5 append. OWRT B-074-IND(2), 14-31-0001-5143.

Descriptors: *Sedimentation rates, *Sediment load, *Reservoirs, *Indiana, *Cores, *Suspended load, *Sedimentation, Iron compounds, Soil water, Soil properties, Measurements, Sediment analysis, Flooded soils, *Monroe Reservoir(IND), Sediment thickness, Sediment budget, Floodplain soils, Sediment cores.

The physical sedimentation system and the sediment and flooded soil properties of Monroe Reservoir in south-central Indiana, were studied. An input-output sediment budget was calculated by relating water discharge through input and output gauges to the amount of sediment transported by the water. Sediment thickness measurements in reservoir bottom cores and detailed profile of bottom topography were made. Suspended sediment in the reservoir water varies with water depth and position on the lake. Sediment load decreases linearly downlake toward the Salt Creek Dam and suspended sediment concentrations are higher near the bottom of the reservoir than near the surface. Sediment thicknesses measured in 46 cores range from 0 to 10 inches with a mean thickness of 2.5 in the upper basin, decreasing to 1.1 in lower basins; this distribution agrees with the prediction of the sediment-load measurements. Averaging results of the input-output and coring studies, the mean total sediment thickness is about 1.2 inches, and the annual storage loss to sediment is 0.05%. No sedimentation problems are foreseen for the reservoir. Bottom cores were analyzed and compared to modern floodplain soils. Flooded soils beneath the reservoir differ from comparable non-flooded soils in the reduction of iron from ferric to ferrous forms due to bottom water chemistry. Extractable calcium and magnesium are significantly lower in flooded soils than in modern floodplain soils. Phosphorous, iron, manganese, carbon, and a large fraction of clay-size particles accumulate in the reservoir sediment. Phosphorous accumulation may be due to bonding between phosphate ions and clay minerals in the sediments. (Seip-IPA)
W78-05815

DETERMINATION OF SOIL HUMUS CONTENT WHEN CONDUCTING FIELD EXPERIMENTS ON ERODED SOILS, (IN RUSSIAN),
Moscow State Univ. (USSR). Faculty of Geography.
For primary bibliographic entry see Field 2G.
W78-05943

THE INTERTIDAL SEDIMENT HABITATS OF THE LOWER MEDWAY ESTUARY, KENT,
Sir John Cass Coll., London (England). School of Science and Technology.
For primary bibliographic entry see Field 5C.
W78-06002

NUTRIENT RELEASE FROM ANAROBIC SEDIMENTS,
Limno-Tech Inc., Ann Arbor, MI.
For primary bibliographic entry see Field 5C.
W78-06007

MIGRATION OF TRACE METALS IN INTERFACES OF SEAWATER AND POLLUTED SURFICIAL SEDIMENTS,
University of Southern California, Los Angeles. Environmental Engineering Program.
For primary bibliographic entry see Field 5B.
W78-06022

ORGANIC MATTER DISTRIBUTION CHARACTERISTICS IN THE SHOAL SEDIMENTS OF THE SELENGA DELTA IN LAKE BAIKAL, (IN RUSSIAN),
Limnologicheskii Inst., Irkutsk (USSR).
For primary bibliographic entry see Field 5B.
W78-06034

ENGINEERING AND PEDOLOGICAL PROPERTIES OF SOILS AS THEY AFFECT SOIL ERODIBILITY,
California Univ., Davis. Dept. of Land, Air, and Water Resources; and California Univ., Davis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2G.
W78-06036

LAST-GLACIAL ALLUVIAL FAN SEDIMENTATION IN THE LOWER DERWENT VALLEY, TASMANIA,
Macquarie Univ., North Ryde (Australia). School of Earth Sciences.
R. J. Wasson.
Sedimentology, Vol. 24, No. 6, p 781-799, December 1977. 11 fig, 3 tab, 40 ref.

Descriptors: *Alluvial fans, *Geomorphology, *Sedimentology, *Pleistocene epoch, Glaciology, Sediments, Deposition(Sediments), Surveys, Particle size, Velocity, Soil properties, Mudflows, On-site investigations, Foreign countries, Foreign research, Petrology, *Tasmania, Debris flow.

Alluvial fans of the last glacial age in the lower Derwent Valley in southeastern Tasmania were

built by debris flows and stream flows. The deposits were derived from periglacial and nivational slope mantles at the highest altitudes in the fan catchments and from regolith of uncertain affinities at the lowest elevations. The apical and middle parts of the fan commonly consist of coarse-grained debris flow and water-laid deposits, while the distal deposits are predominantly water-laid sheetflood silts and clays. Channels are important in the proximal parts of the fans and are mostly filled with water-laid sediments, less commonly by debris flow deposits. A first approximation to the mean velocity of the last stage of debris flow in a channel is between 4 m/sec and 6 m/sec. A group of 'water-laid' sediments showed very poor separation of particle sizes, and two explanations were offered for these sediments. Firstly, the large quantities of unsorted debris available from the catchments produced moderately well-sorted slurries, or, secondly, openwork stream gravels were infiltrated by later water flows charged with fines. The streams crossing the fans also produced water flows relatively low suspended sediment concentrations resulting in reasonably good sorting. The debris flows and 'water-laid' muddy sediments cannot be distinguished using CM plots. The debris flows display considerable variation in thickness and grain-size characteristics, which is attributable to properties inherent in debris flow behavior. (Humphreys-ISWS)
W78-06105

PACKING AND ANGLE OF REPOSE OF NATURALLY SEDIMENTED FINE SILICA SOLIDS IMMERSED IN NATURAL AQUEOUS ELECTROLYTES,
Imperial Coll. of Science and Technology London (England). Dept. of Civil Engineering.
P. A. Mantz.
Sedimentology, Vol. 24, No. 6, p 819-832, December 1977. 5 fig, 2 tab, 24 ref.

Descriptors: *Sedimentology, *Soil compaction, *Laboratory tests, *Aqueous solutions, Silica, Sediments, Sands, Electrolytes, Soil stability, Soil properties, Soil physical properties, Testing procedures, Angle of repose, Packing coefficient.

Six grades of near uniformly sized silica solids (ranging in median size from 15 micrometers to 160 micrometers) were sedimented in various natural aqueous electrolytes. The influence of surface forces on these silica-electrolyte systems was then inferred from measurements of the packing coefficient, C, of each sediment. It was found that the packings were uninfluenced by surface chemical forces when the grade size was greater than about 100 micormeters. For smaller grades immersed in naturally concentrated aqueous electrolytes, C was found to decrease from an initial value of about 0.50, and this was explained by the onset of surface chemical attractive forces. For smaller grades immersed in pure water, C was found to increase to a maximum of 0.58. Three explanations for this phenomenon, namely a difference in shape with grade size, a decrease in intensity of deposition, and the onset of surface chemical repelling forces, were examined, and the latter explanation seemed the most probable. Measurements of the angle of repose for the sediments also showed the influence of surface chemical repelling as well as attractive forces in fine silica solids. The results may be used to aid interpretation of the fabric and stability of pre-lithified sedimentary units. (Humphreys-ISWS)
W78-06106

TRENDS OF SEDIMENT REMOVAL FROM ARID SCREE SLOPES UNDER SIMULATED RAINSTORM EXPERIMENTS,
Hebrew Univ., Jerusalem (Israel). Dept. of Geography.
A. Yair, and H. Lavee.
Hydrological Sciences Bulletin, Vol. 22, No. 3, p 379-391, September 1977. 7 fig, 2 tab, 20 ref.

Descriptors: *Sediment transport, *Storms, *Simulated rainfall, Sediment yield, Erosion, Rainfall simulators, Raindrops, Sediment discharge, Hydrology, Runoff.

In the framework of an experiment devoted to the study of runoff generation on six arid talus mantled slopes, runoff samples loaded with fine sediment were taken at short intervals. The samples allowed an analysis to be made of the relationships existing between sediment concentration and sediment discharge to the runoff discharge of such slopes. Sediment concentrations varied from 0.5 to 59 g/l, and sediment yields from 0.9 to 24.2 g/sq m. Whereas a positive linear relationship was obtained between runoff discharge and sediment discharge, no clear relationship was obtained between runoff discharge and sediment concentration. The highest concentrations were recorded in the initial runoff, followed by a rapid decrease in concentration during the rising flow stage. A second part of sediment concentration appeared at the fall stage of the flow. These results were explained tentatively by the varying role of splash and flow velocity on sediment detachment and transport processes during the flow event. (Lee-ISWS)
W78-06108

I. DYNAMICS OF MERCURY IN LAKE SEDIMENTS. II. STUDIES ON ORGANIC PHOSPHORUS IN SOILS IRRIGATED WITH MUNICIPAL WASTEWATERS,
Purdue Univ., Lafayette, IN.
For primary bibliographic entry see Field 5C.
W78-06137

SEDIMENTATION IN SANTA MARGARITA LAKE, SAN LUIS OBISPO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
G. D. Glysson.
Water-Resources Investigations 77-56, September 1977. 15 p, 7 fig, 6 tab, 11 ref.

Descriptors: *Reservoir storage, *Sedimentation, Deposition(Sediments), *Sedimentation rates, *California, Inflow, Streamflow, Sediment yield, *Santa Margarita Lake(Calif), San Luis Obispo County(Calif), Salinas River(Calif).

The 1975 storage capacity of Santa Margarita Lake in San Luis Obispo County, Calif., was 41,400 acre-feet, a decrease of 3,400 acre-feet since 1941. Usable capacity decreased from 25,800 to 23,000 acre-feet. Long-term sediment yield for the Salinas River basin upstream from the lake was estimated at 1,150 tons per square mile per year. A correlation between the annual water discharge of the Salinas River near Pozo and the annual quantity of sediment deposited in the lake was developed that can be used to stimate future sediment deposition. (Woodard-USGS)
W78-06182

HYDROLOGY AND WATER QUALITY OF THE ATCHAFALAYA RIVER BASIN,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W78-06184

PALEOGEOCHEMISTRY AND INTERSTITIAL WATER CHEMISTRY FROM SEDIMENTS OF FIVE MAINE LAKES,
Maine Univ. at Orono. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2H.
W78-06199

2K. Chemical Processes

CHEMICAL SYSTEMS MONROE RESERVOIR, INDIANA,
Indiana Univ., Bloomington. Dept. of Geology.
For primary bibliographic entry see Field 2H.
W78-05805

ANALYSIS OF THE F_UORINE ION IN THE PRESENCE OF AL AND CA IONS IN AIR AND WATER WITH THE USE OF ZR-SPADNS REAGENT, (IN RUSSIAN),
For primary bibliographic entry see Field 5A.
W78-06008

A PROPOSED MODIFICATION TO THE CLASSICAL METHOD OF CALCULATING ALKALINITY OF NATURAL WATERS,
Auburn Univ., AL.
For primary bibliographic entry see Field 5A.
W78-06019

HYDROGEN INPUT TO THE HUBBARD BROOK EXPERIMENTAL FOREST, NEW HAMPSHIRE, DURING LAST DECADE,
Cornell Univ., Ithaca, NY. Section of Ecology and Systematics.
For primary bibliographic entry see Field 5A.
W78-06026

THE CHEMICAL COMPOSITION OF ATMOSPHERIC PRECIPITATION FROM SELECTED STATIONS IN MICHIGAN,
Michigan Univ., Ann Arbor. School of Natural Resources.
For primary bibliographic entry see Field 5A.
W78-06027

THE COLLECTION OF PRECIPITATION FOR CHEMICAL ANALYSIS,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
J. N. Galloway, and G. E. Likens.
Tellus, Vol 30, No 1, p 71-82, February 1978. 2 fig, 6 tab, 12 ref.

Descriptors: *Precipitation(Atmospheric), *Sampling, *Chemical analysis, *Chemistry of precipitation, Equipment, Precipitation gages, Rain gages, Rain, Rain water, Snow, Fallout, Data collections, Chemical analysis, Chemistry, Meteorology, Collectors.

This paper was one of a series of publications on the collection and chemical analysis of precipitation. While the first paper presented the results from an intercalibration of 10 different designs of precipitation collectors, this paper presented results of experiments on the collection efficiency of collectors, preservation of samples, monthly variation of wet and dry deposition, sample storage, length of sampling period, choice of collector location, and sources of variability in precipitation data. The primary conclusions were that dry fallout usually should be excluded from rain and snow samples, sampling should be on an event basis, all biocides tested have some detrimental effect on sample composition, and that the major sources of variability in precipitation data are due to sampling errors and choice of collector location. (Sims-ISWS)
W78-06112

GROUND-WATER RESOURCES OF EMMONS COUNTY, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 4B.
W78-06179

2L. Estuaries

PROPAGATION AND USE OF SPARTINA ALTERNIFLORA FOR SHORELINE EROSION ABATEMENT,
North Carolina State Univ. at Raleigh.
For primary bibliographic entry see Field 4A.
W78-05751

INTERACTION OF TSUNAMIS WITH THE HAWAIIAN ISLANDS CALCULATED BY A FINITE-ELEMENT NUMERICAL MODEL,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
J. R. Houston.
Journal of Physical Oceanography, Vol 8, No 1, p 93-102, January 1978. 8 fig, 17 ref.

Descriptors: *Tsunamis, *Hawaii, *Model studies, *Mathematical models, *Pacific Ocean, Waves(Water), Ocean waves, Coasts, Islands, Gages, Equations, Finite element analysis, Analytical techniques, Mathematics, Oceanography.

A finite element numerical model was used to determine the interaction of tsunamis with the Hawaiian Islands. The model employs a finite element grid which telescopes from a large cell size in the deep ocean to a very small size in shallow coastal waters and covers a region which included the eight major islands of the Hawaiian Islands. The numerical model solves the problem of tsunami propagation from the deep ocean to the coasts of these islands. Although time periodic motion was assumed in the solution, the interaction of an arbitrary tsunami waveform with the islands can be determined easily within the framework of a linear theory by superposition. The deep ocean waveforms of the 1960 and 1964 Alaskan tsunamis were determined for use as input to verify the finite element model by employing a finite difference numerical model which assumes as an initial condition that the uplift movement of the sea floor in the source regions during an earthquake is instantaneous and results in a water surface elevation identical to the known permanent vertical displacement of the sea floor. The finite difference model propagates the waves radiated from the source regions to a deep ocean area near the Hawaiian Islands using a two-dimensional spherical coordinate grid to solve the linear long wave equations. The finite element model was deep water time histories as input. Numerical model calculations were shown to be in good agreement with tide gage recordings of the 1964 Alaskan tsunami at Kahului, Maui; Honolulu, Oahu; Hilo, Hawaii; and the 1960 Chilean tsunami at Honolulu, which was the only location where the 1960 tsunami did not destroy the gage. (Sims-ISWS)
W78-05772

DRIFT RESPONSE OF MONOMOLECULAR SLICKS TO WAVE AND WIND ACTION,
Hamburg Univ. (West Germany).
P. Lange, and H. Huhnerfuss.
Journal of Physical Oceanography, Vol 8, No 1, p 142-150, January 1978. 7 fig, 3 tab, 40 ref.

Descriptors: *Monomolecular films, *Drifting(Aquatic), *Waves(Water), *Winds, Laboratory tests, On-site investigations, Ocean waves, Gravity waves, Velocity, Alcohols, Evaporation, Air-water interfaces, Oceanography, Path of pollutants, *Sylt(Germany), *North Sea, Monomolecular slicks, Ocean slicks.

The drift responses of monomolecular slicks to wind and wave action were investigated in a laboratory wind-wave tunnel and in the field. The wind-wave tunnel was fitted with a mechanical wave generator which produced uniform, long-crested gravity waves. The field studies were performed off the island of Sylt (German Bight) in the North Sea. Laboratory results for the slick drift response to deep water gravity waves only were in excellent agreement with the Stokes irrotational mass transport drift velocity theory. The purely wind-induced slick drift was in good agreement with the results obtained by previous investigators using a variety of other floats. A number of laboratory and field investigatons were compared and showed that the surface drift to wind speed ratio lies between 2.6-5.5%. A difference between the average ratios for the collected laboratory and field results indicated that the pure gravity wave drift component probably comprises 25-30% of the total surface drift. A qualitative example confirming this was demonstrated in the field studies. A laboratory treatment of the combined wind and wave slick drift showed that the effects of wind and waves cannot be simply superimposed. In some cases, the gravity waves appear to decouple the wind drift, especially at lower wind speeds. (Sims-ISWS)
W78-05773

THE USE OF FAECAL BACTERIA AS A TRACER FOR SEWAGE SLUDGE DISPOSAL IN THE SEA,
Ministry of Agriculture, Fisheries and Food, Burnham-on-Crouch (England). Fisheries Lab.
For primary bibliographic entry see Field 5B.
W78-05876

A FAECAL STEROL SURVEY IN THE CLYDE ESTUARY,
Bristol Univ. (England). Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W78-05879

DISTRIBUTION OF VIRAL AND BACTERIAL PATHOGENS IN A COASTAL CANAL COMMUNITY,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
For primary bibliographic entry see Field 5B.
W78-05880

NEARSHORE SEDIMENT POLLUTION IN ISRAEL BY TRACE METALS DERIVED FROM SEWAGE EFFLUENT,
Hebrew Univ. of Jerusalem, Rehovot (Israel). Dept. of Soil and Water Science.
For primary bibliographic entry see Field 5B.
W78-05887

DISCHARGE OF NITROGEN, PHOSPHORUS AND ORGANIC MATTER INTO THE GULF OF BOTHNIA,
National Swedish Environment Protection Board, Uppsala. Limnological Survey.
For primary bibliographic entry see Field 5B.
W78-05905

OIL POLLUTION ON THE POLISH COAST OF THE BALTIC SEA, (IN POLISH),
For primary bibliographic entry see Field 5C.
W78-05907

COASTAL WATER RESEARCH PROJECT. ANNUAL REPORT FOR THE YEAR ENDED 30 JUNE 1977.
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5B.
W78-05911

COASTAL CURRENTS,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5B.
W78-05916

POLLUTANTS IN SEDIMENTS OFF PALOS VERDES,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5B.
W78-05917

SATELLITE IMAGERY STUDIES,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5B.
W78-05919

EFFECTS OF CLIMATIC CYCLES ON THE RELATIVE ABUNDANCE AND AVAILABILITY OF COMMERCIAL MARINE AND ESTUARINE SPECIES,
Maine State Dept. of Marine Resources, Augusta.
R. L. Dow.
Journal of Conseil International Pour L'Exploration de la Mer, Vol. 37, No. 3, September 1977, p 274-280, 1 fig, 4 tab, 16 ref.

Descriptors: Environmental effects, *Seasonal, Temperature, Aquatic life, Estuaries, Populations, Fish, Climates, Cycles, Estuarine fisheries, Marine fisheries, Fish management, *Boothbay Harbor(Maine), *Sea water temperature.

Simple linear correlation utilizing arithmetic means of sea surface temperature at Boothbay Harbor, Maine, were used in the studies. Evidence showed that sea temperatures have been the principal environmental regulator of species abundance and availability. This dependence on periodic and widely varying sea temperature cycles for maximum abundance of each of more than 30 commercially important species creates major problems for effective fisheries management. (Chilton-ORNL)
W78-05957

IMPORTANCE OF EELGRASS BEDS IN PUGET SOUND,
National Marine Fisheries Service, Beaufort, NC. Beaufort Lab.
G. W. Thayer, and R. C. Phillips.
Marine Fisheries Review, Vol 39, No 11, November 1977, p 18-22, 2 fig, 1 tab, 8 ref.

Descriptors: *Ecology, Habitats, Aquatic habitats, Predation, Protection, Aquatic environment, Aquatic plants, Food chains, *Puget Sound(Wash), Washington, Detoitus, *Eelgrass.

Observations and research efforts have shown that the importance of eelgrass systems does not necessarily lie in their direct food value to organisms but in their multifaceted functions. They provide a habitat for the growth of ecologically important fish and invertebrates. Because of normally dense growth, seagrasses also provide small organisms a significant degree of protection from predators. Eelgrass leaves have a high rate of growth and although few organisms feed directly on the leaves, the major food chains are based on detritus derived from the leaves which may support food chains in adjacent waters. The blades support many small epiphytic organisms. The roots bind the sediments and remove nutrients from the substrate. (Chilton-ORNL)
W78-05958

STRUCTURE OF PELAGIC FOOD CHAIN AND RELATIONSHIP BETWEEN PLANKTON AND FISH PRODUCTION,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
R. W. Sheldon, W. H. Sutcliffe, Jr, and M. A. Paranjape.
Journal of the Fisheries Research Board of Canada, Vol. 34, 1977, p 2344-2353, 6 fig, 54 ref.

Descriptors: Biological communities, *Fish management, Production, Ecosystems, *Plankton, Phytoplankton, Fish, Estimating, Predation, Peru, North Sea, Gulf of Maine, *Food chains, *Pelagic ecosystems.

The simplified view of the pelagic food chain, based essentially on particle size spectra, shows that by considering the interactions of organisms relative to their size it is possible to arrive at a plausible structure for the pelagic food chain. From this, estimates of plankton and fish production are derived. Phytoplankton production is estimated from fishery production for the Gulf of Maine and the North Sea and fishery production is estimated from plankton production for an area off Peru. (Chilton-ORNL)
W78-05961

SEASONAL CHANGES IN THE COMMUNITY STRUCTURE OF THE MACROBENTHOS INHABITING THE INTERTIDAL SAND AND MUD FLATS OF BARNSTABLE HARBOR, MASSACHUSETTS,
Chicago Univ., IL. Committee on Evolutionary Biology.
R. B. Whitlatch.
The Biological Bulletin, Vol. 152, No. 2, April 1977, p 275-294, 6 fig, 2 tab, 64 ref.

Descriptors: Environmental effects, *Seasonal, Biological communities, Populations, Benthos, Intertidal areas, Mud flats, Sands, Massachusetts, *Barnstable Harbor(Mass), *Distribution patterns, *Classification.

Thirty two species of benthic macrofauna used in an inverse classification analysis were partitioned into 10 species groups, reflecting spatial distibutional patterns. More than 90% of all organisms sampled were deposit-feeders which normally dominate mud and muddy-sand sediments. Suspension-feeders were most abundant in fine sands. While no significant changes were evident in species diversity, eveness, or species number during the 19 month sampling period, classification analysis delimited seasonal clustering of both samples and species groupings. These patterns were repeatable over a two year period suggesting that dynamic equilibrium, not successional change was occurring. Seasonal clustering patterns of some species were related to the appearance of different zoogeographic faunal province elements. (Chilton-ORNL)
W78-05967

ALKALINE POTASSIUM PERMANGANATE DEGRADATION OF INSOLUBLE ORGANIC RESIDUES (KEROGEN) ISOLATED FROM RECENTLY-DEPOSITED ALGAL MATS,
California Univ., Berkeley. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W78-06000

THE INTERTIDAL SEDIMENT HABITATS OF THE LOWER MEDWAY ESTUARY, KENT,
Sir John Cass Coll., London (England). School of Science and Technology.
For primary bibliographic entry see Field 5C.
W78-06002

NITROGEN CYCLES IN A POLLUTED SEA AREA,
Tokyo Univ. (Japan). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5C.
W78-06004

DIELDRIN-INDUCED DESTRUCTION OF MARINE ALGAL CELLS WITH CONCOMITANT DECREASE IN SIZE OF SURVIVORS AND THEIR PROGENY,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 5C.
W78-06011

OCEAN DUMPING: PHILADELPHIA'S STORY.
For primary bibliographic entry see Field 5E.
W78-06021

MIGRATION OF TRACE METALS IN INTERFACES OF SEAWATER AND POLLUTED SURFICIAL SEDIMENTS,
University of Southern California, Los Angeles. Environmental Engineering Program.
For primary bibliographic entry see Field 5B.
W78-06022

A SEARCH FOR CYTOPATHOGENIC VIRUSES IN SURFACE AND COASTAL SEA WATER IN THE PROVINCE OF PISA (ITALY), (IN ITALIAN),
Pisa Univ. (Italy). Ist. di Igine.
For primary bibliographic entry see Field 5B.
W78-06023

ECOLOGICAL STUDIES IN THE WESTERN SACRAMENTO-SAN JOAQUIN DELTA DURING A DRY YEAR,
California Univ., Davis. Dept. of Water Science and Civil Engineering.
C. A. Siegfried, A. W. Knight, and M. E. Kopache.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 665, Price codes: A07 in paper copy, A01 in microfiche. Water Science and Engineering Papers, No 4506, January, 1978. 121 p, 55 fig, 5 tab, 75 ref, append. (Funded by Dow Chemical Company, Pittsburg, CA. and Calif. Water Resources Council).

Descriptors: *Benthos, *Ecology, *Droughts, *Saline Water Intrusion, Encroachment, Saline-Freshwater interfaces, Low-flow, Water quality, Drought tolerance, *California, Deltas, Clams, Oligochaetes, Polychaetes, Amphipods, Standing crops, Deposition(Sediments), *Sacramento-San Joaquin(Calif).

A portion of the Western Sacramento-San Joaquin Delta was studied by the UCD Estuarine Research Group during 1976, a critical dry year. Particularly important to the ecology of the Delta, in 1976, was the low outflow, the fourth-lowest on record. The most important aspect of water quality during 1976 was salinity incursion accompanying low flows. The flow flows caused the entrapment zone to be located upstream from Chipps Island during much of 1976. The location of the entrapment zone in the San Francisco Bay Estuary is thought to be very important in the ecology of the Delta. The benthic community of the Western Delta was dominated by the Asiatic clam (Corbicula manilensis), oligochaetes, the amphipods Corophium stimpsoni and C. spinicorne, and a spionid polychaete, Boccardia ligrerica. These taxa averaged 98% of the total benthic macroinvertebrates collected at each study site. Changes in benthos composition are thought to be related to salinity incursion and changes in substate composition resuling from the deposition of fine sediments during summer. In general, the upstream channel stations had higher standing crops of benthos than the other stations in the study area in 1976. Total benthic standing crop was lowest near Chipps Island. The standing crop peaked in June and was lowest in November. (Snyder-Calif, Davis)
W78-06042

EFFECTS OF POLLUTION ON WATER QUALITY, PERDIDO RIVER AND BAY, ALABAMA AND FLORIDA.
Federal Water Pollution Administration, Athens, GA. Southeast Water Lab.
For primary bibliographic entry see Field 5C.
W78-06044

PHYTOPLANKTON GROWTH, DISSIPATION AND SUCCESSION IN ESTUARINE ENVIRONMENTS,
Johns Hopkins Univ., Baltimore, MD.
For primary bibliographic entry see Field 5C.
W78-06047

ANALYSIS OF OPERATION 'DEEP SIX' BENTHIC INVERTEBRATES.
Marine Research Inc., Falmouth, MA.
For primary bibliographic entry see Field 5C.
W78-06052

THE ENVIRONMENTAL IMPACT OF FRESHWATER WETLAND ALTERATIONS ON COASTAL ESTUARIES.
Georgia Dept. of Natural Resources, Atlanta. Office of Planning and Research.
For primary bibliographic entry see Field 5C.
W78-06053

PRODUCTIVITY AND NUTRIENT EXPORT STUDIES IN A CYPRESS SWAMP AND LAKE SYSTEM IN LOUISIANA,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
For primary bibliographic entry see Field 5C.
W78-06054

OBSERVATION ON PRODUCTIVITY OF SWAMP STREAMS IN EASTERN NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5C.
W78-06056

HYDROLOGIC AND ENVIRONMENTAL EFFECTS OF A LONG-TERM DRAINAGE ON A COASTAL AREA, (CASE STUDY: MELBOURNE TILLMAN DRAINAGE DISTRICT, PALM BAY, FLORIDA),
Florida Inst. of Tech., Melbourne. Center for Coastal Zone Research.
D. D. Barile.
In: The Environmental Impact of Freshwater Wetland Alterations on Coastal Estuaries, Conference held at Savannah, Georgia on June 23, 1976. p 47-59, 5 fig, 1 tab, 7 ref.

Descriptors: *Environmental effects, *Hydrologic aspects, Melbourne Tillman Drainage District(FL), *Palm Bay(FL), *Drainage effects, Drainage systems, Freshwater-saline water interfaces, Coastal marshes, Burning, Estuaries, Estuarine environment, Vegetation effects, Succession, Water levels, Salinity, Shellfish, Sediments, Nutrients, Flood protection, Saline water intrusion, Droughts, *Florida.

Operations of the Melbourne Tillman Drainage District (MTDD) Palm Bay, Florida were used for an analysis of consequences of large-scale and long-term drainage from wetlands into estuaries. A 98 sq m area of the St. Johns River marsh has been drained by the MTDD since 1924. Water is carried by a 200 m grid of canals through a drainage divide and introduced into the Indian River estuarine lagoon by way of a natural stream, Turkey Creek. Systems analysis was used to define changes in the area from 1900 to 1975 and to investigate effects of a future drainage plan. Effects of drainage and population growth were noted in the upland, the coastal area, and in the estuary. The incidence of fire increased as water was removed from marshes. Marshes were reduced in size, prairies were replaced by pine lands, and recently introduced exotics replaced native growth. The amount of water stored in the shallow ground aquifer has decreased by 13%. The amount of water flowing through Turkey Creek has increased from 5% of rainfall to 28%, thus decreasing the salinity and destroying the productive shellfish

beds. Water entering the estuary has decreased in quality through the additional nutrient and sediment loading from the sewer discharge and through the reduced time period that the water spent in the upland sloughs, swamps, and marshes. Planners in coastal areas face two problems: (1) drainage and flood protection; (2) water supply and prevention from salt water encroachment during drought conditions. (See also W78-06053) (Harris-Wisconsin)
W78-06057

PLANNING FOR CLEANING UP AN ESTUARY--PART II: PHYSICAL PLANNING FOR THE MERSEY,
For primary bibliographic entry see Field 5G.
W78-06062

ALTERNATIVE MANAGEMENT STRATEGIES FOR VIRGINIA'S COASTAL WETLANDS: A PROGRAM OF STUDY,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 6G.
W78-06086

WETLAND MAPPING IN NEW JERSEY AND NEW YORK,
Earth Satellite Corp., Washington, DC.
For primary bibliographic entry see Field 7C.
W78-06092

SEASONAL MEASUREMENTS OF CARBON, NITROGEN, ASH, IRON, CARBOHYDRATES, AND PIGMENTS FROM GEOGRAPHICALLY DIFFERENT SPARTINE ALTERNIFLORA MARSHES IN THE SOUTHEAST,
Skidway Inst. of Oceanography, Savannah, GA.
For primary bibliographic entry see Field 2I.
W78-06093

THE ARRESTED TOPOGRAPHIC WAVE,
Woods Hole Oceanographic Institution, MA.
For primary bibliographic entry see Field 2H.
W78-06117

A LABORATORY STUDY OF THE STABILITY OF SAND-FILLED NYLON BAG BREAKWATER STRUCTURES,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 8G.
W78-06121

IDENTIFICATION OF RELEVANT CRITERIA AND SURVEY OF POTENTIAL APPLICATION SITES FOR ARTIFICIAL HABITAT CREATION, VOLUME I, RELEVANT CRITERIA FOR MARSH-ISLAND SITE SELECTION AND THEIR APPLICATION.
Coastal Zone Resources Corp., Wilmington, NC.
For primary bibliographic entry see Field 5G.
W78-06128

ORGANOCHLORINE RESIDUES IN POTENTIAL FOOD ITEMS OF MARINE BALD EAGLES (HALIAEETUS LEUCOCEPHALUS), 1966 AND 1974,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
For primary bibliographic entry see Field 5A.
W78-06164

BLOOMS OF GYRODINIUM AUREOLUM (DINOPHYCEAE) IN NORTH EUROPEAN WATERS, ACCOMPANIED BY MORTALITY IN MARINE ORGANISMS,
Oslo Univ. (Norway). Dept. of Limnology. and Oslo Univ. (Norway) Inst. of Marine Biology.
For primary bibliographic entry see Field 5C.
W78-06165

THE EFFECT OF TEMPERATURE ON THE DISTRIBUTION AND BIOMASS OF MYTILUS EDULIS IN THE ALAMITOS BAY AREA,
Claremont Graduate Schools, CA. Dept. of Joint Science.
For primary bibliographic entry see Field 5C.
W78-06166

SOURCES OF VARIABILITY IN THE BENTHIC MACROFAUNA OFF THE SOUTH NORTHUMBERLAND COAST, 1971-1976,
Dove Marine Lab., Cullercoats, (England).
J. B. Buchanan, M. Sheader, and P. F. Kingston.
Journal of the Marine Biological Association of the United Kingdom, Vol 58, p 191-209, 1978. 18 fig, 4 tab, 10 ref.

Descriptors: *Spatial distribution, *Temporal distribution, *Variability, *Water temperature, *Seasonal, *Silts, *Sediments, Mortality, Population, *Aquatic populations, *Annual succession, *Flucturations, Distribution, Biomass, *Benthic fauna, Diversity, *Northumberland Coast(England).

Spatial and temporal variability for the period 1971-76 has been assessed, using data from five monitoring stations and two broad surveys of the Northumberland coast. Ordination of the broad survey stations relates the faunal assemblages to depth and the silt content of the sediment, and suggests that their distribution has remained essentially stable for more than a decade. Diversity is negatively correlated with silt content of the sediment but shows no correlation with depth. Biomass is negatively correlated with depth but shows no correlation with sediment type. It is suggested that, in areas with un unstable temperature regime, different suites of species enjoy competitive advantage at different points of the temporal range of temperature variability. This in turn allows the community to maximize its performance throughout a broad range of environmental variability. (Dael-EIS)
W78-06167

HEAVY METALS IN THE BURROWING BIVALVE SCROBICULARIA PLANA FROM THE TAMAR ESTUARY IN RELATION TO ENVIRONMENTAL LEVELS,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
For primary bibliographic entry see Field 5C.
W78-06169

FEEDING RATE OF MYTILUS EDULIS L. (BIVALVIA) FROM DIFFERENT PARTS OF DANISH WATERS IN WATER OF DIFFERENT TURBIDITY,
Copenhagen Univ. (Denmark). Zoological Lab.
B. F. Theisen.
Ophelia, Vol 16, No 2, p 221-232, 1977. 6 fig, 2 tab, 20 ref.

Descriptors: Animal behavior, *Yeasts, *Feeding rates, *Commercial shellfish, *Turbidity, *Suspended solids, *Filters, Animal physiology, *Mollusks, Aquatic environment, *Denmark, *Wadden Sea(Denmark), Limfjord(Denmark), Bivalve, Gills.

The feeding rate of Mytilus edulis was measured in different concentrations of talcum simulating different concentrations of mud. Dyed yeast was used as food. The feeding rate decreased drastically with increased concentrations of talcum. At high concentrations of talcum Mytilus from the Wadden Sea fed at about twice the rate as Mytilus from other Danish waters. This is correlated with the size of the labial palps which are about twice as large in Mytilus from the Wadden Sea as in Mytilus from other Danish waters. (Dael - EIS)
W78-06170

PUBLIC WATER SUPPLIES OF NORTH CAROLINA, PART 5. SOUTHERN COASTAL PLAIN,
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 4A.
W78-06178

REPORT OF THE RIVER MASTER OF THE DELAWARE RIVER FOR THE PERIOD DECEMBER 1, 1975 -- NOVEMBER 30, 1976,
Geological Survey, Reston, VA. Water Resources Div., and Geological Survey, Milford, PA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W78-06181

SIMULATION OF WASTEWATER INJECTION INTO A COASTAL AQUIFER SYSTEM NEAR KAHULUI, MAUI, HAWAII,
Geological Survey, Reston, VA. Water Resources Div., and Geological Survey, Tallahassee, FL. Water Resources Div., and Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W78-06186

COASTAL WETLANDS: THE PRESENT AND FUTURE ROLE OF REMOTE SENSING,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7B.
W78-06188

LAND-SURFACE SUBSIDENCE IN THE HOUSTON-GALVESTON REGION, TEXAS,
Geological Survey, Houston, TX. Water Resources Div.
For primary bibliographic entry see Field 2F.
W78-06195

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

EVALUATION OF NEW REVERSE OSMOSIS MEMBRANES FOR THE SEPARATION OF TOXIC COMPOUNDS FROM WASTEWATER,
Illinois Univ. at Urbana-Champaign. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5D.
W78-05950

SALT EXTRACTION FROM SULFATE SALINIZED SOIL IN THE KOPET-DAG PIEDMONT PLAIN STUDIED BY MODELING OF LEACHING, (IN RUSSIAN),
For primary bibliographic entry see Field 3C.
W78-06009

PRESSURE DRIVEN MEMBRANE PROCESSES IN THE TREATMENT OF INDUSTRIAL EFFLUENTS,
Israel Desalination Engineering Ltd. Tel Baruch.
For primary bibliographic entry see Field 5D.
W78-06075

MEMBRANE PROCESSES USED FOR THE TREATMENT OF INDUSTRIAL EFFLUENTS,
Istituto di Ricerca sulle Acque, Rome (Italy).
For primary bibliographic entry see Field 5D.
W78-06082

SEDIMENTATION ON THE MEMBRANE SURFACE OF A HYPERFILTRATION WATER-DISTILLING APPARATUS, (IN RUSSIAN),
Desert Inst., Ashkhabad (USSR).
A. A. Khachaturyan, E. S. Yushkevich, and D. Dzhaparov.
Probl Osvo Pustyn 6, p 69-72, 1976.

Descriptors: *Sedimentation, Filtration, *Hyperfiltration, *Distrillation, Membranes, Deserts, Hydrogen ion concentration, Desalination, Irrigation, Pastures.

A system used for irrigating desert pastures is described. To avoid the formation of sediments (e.g., bacteria) on the membrane surface of the hyperfiltration distillator the composite forces must be directed either off the membranes or tangent to their surfaces. The water flow in the chambers of the distillator must remove compacted particles from the cells and the pH of the solution under distillation must be corrected.--Copyright 1978, Biological Abstracts, Inc.
W78-06091

3B. Water Yield Improvement

INTERFEROMETRIC OBSERVATIONS OF THE TEMPERATURE STRUCTURE IN WATER COOLED OR HEATED FROM ABOVE,
Purdue Univ., Lafayette, IN. Heat Transfer Lab.
For primary bibliographic entry see Field 2D.
W78-05942

FINAL REPORT TO THE NATIONAL SCIENCE FOUNDATION RESEARCH APPLIED DIRECTORATE WEATHER MODIFICATION ASSOCIATION,
Wyoming Univ., Laramie. Dept. of Atmospheric Science.
A. H. Auer, Jr., and F. D. Eaton.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 029, Price codes: A03 in paper copy, A01 in microfiche. Final Report NSF/RA-760255, June 30, 1976. 45 p, 14 fig, 1 tab, 2 ref, 2 append. NSF AEN 76-00898.

Descriptors: *Weather, *Cities, *Missouri, *On-site investigations, *Remote sensing, Atmosphere, Clouds, Cloud physics, Weather modification, Precipitation(Atmospheric), Humidity, Instrumentation, Meteorology, *St Louis(Mo), Lidar.

The goal of the Metropolitan Experiment (Metromex) was to derive an understanding of the effects of urbanized and industrialized areas on the local and regional behavior of the atmosphere, with primary attention to modification of the precipitation-producing process. Within this framework, the study attempted to make comparative observations of urban and non-urban environments to determine processes responsible for differences in boundary layer signature, wind fields, and resultant convective cloud behavior, traceable to urban-induced changes in heat, humidity, and aerosols. Primarily, this research program provided objective documentation, on a diurnal basis, of urban influence on: (1) mixing depth and other boundary layer structures; (2) cloud base height and formation frequency; and (3) precipitation elements in the St. Louis urban/rural area. In addition, time and space variations of these observed atmospheric structures qualitatively were related to other meteorological measruements. It then was possible to identify dynamic, radiative, and physical processes that may contribute to the precipitation anomaly. (Sims-ISWS)
W78-06130

3C. Use Of Water Of Impaired Quality

SUPPLEMENTAL COLORADO RIVER WATER FOR A DEVELOPED GROUNDWATER AGRICULTURE: A PROBLEM OF QUANTITIES, QUALITIES AND CONJUNCTIVE USE,
Fish and Wildlife Service, Washington, DC. Office of Biological Services.
For primary bibliographic entry see Field 4B.
W78-05705

SALT EXTRACTION FROM SULFATE SALINIZED SOIL IN THE KOPET-DAG PIEDMONT PLAIN STUDIED BY MODELING OF LEACHING, (IN RUSSIAN),
Probl Osvo Pustyn 1, p 46-53, 1977.

Descriptors: *Saline soils, *Leaching, Model studies, *Sulfates, Soil profiles, *Salt leaching, Soil moisture, *Kopet-Dag piedmont plain(USSR), Turkman SSR, Desalination.

The succession in salt leaching from a soil profile by descending water flowing in it, and secondary salt formation were studied in leached soil profiles. The water rate needed to leach salts was 11,800 m3/ha for meadow solonchaks and 10,500 m3/ha for light serozems, which correlated with 4.3-4.5% of the moisture volume of maximum field moisture capacity. These rates were recommended to leach salts from soil profiles in the Kopet-Dag (Turkmen SSR, USSR) piedmont plain salinized with sulfates.--Copyright 1978, Biological Abstracts, Inc.
W78-06009

DYNAMICS OF WATER-SOLUBLE SALTS IN SOIL IRRIGATED WITH SEWAGE WATER,
For primary bibliographic entry see Field 5D.
W78-06010

SEDIMENTATION ON THE MEMBRANE SURFACE OF A HYPERFILTRATION WATER-DISTILLING APPARATUS, (IN RUSSIAN),
Desert Inst., Ashkhabad (USSR).
For primary bibliographic entry see Field 3A.
W78-06091

HERBICIDE REPORT: CHEMISTRY AND ANALYSIS, ENVIRONMENTAL EFFECTS, AGRICULTURAL AND OTHER APPLIED USES.
Environmental Protection Agency, Washington, D.C. Hazardous Materials Advisory Committee.
For primary bibliographic entry see Field 5A.
W78-06133

3D. Conservation In Domestic and Municipal Use

PRICE VARIABLE IN RESIDENTIAL WATER DEMAND MODELS,
Oregon State Univ., Corvallis. Dept. of Resource Recreation Management.
For primary bibliographic entry see Field 6D.
W78-05703

DECISION-MAKING IN THE DEVELOPMENT OF URBAN WATERFRONTS FOR PARK/BUSINESS USE,
Texas A and M Univ., College Station. Dept. of Recreation and Parks.
For primary bibliographic entry see Field 6B.
W78-05716

A PUBLIC EDUCATION CAMPAIGN TO CONSERVE WATER,
Washington Suburban Sanitary Commission, Hyattsville, MD.
A. P. Brigham.
Journal of American Water Works Association, Vol. 68, No. 12, p 665-668, December 1976. 2 fig, 1 tab.

Descriptors: *Public education, *Social aspects, *Water conservation, *Water demand, *Washington, D.C., Education, Water utilization, Water supply, District of Columbia, Maryland, Utilities, Attitudes, Motivation, Social participation, Washington Suburban Sanitary Commission.

A public water conservation campaign begun in 1970 by the Washington Suburban Sanitary Commission (WSSC) substantially reduced water use in the bi-country Maryland area adjacent to Washington, D.C. Between fall 1971 and June 1973 water use dropped from 101.6 gpcd to 100.2 gpcd, a net minimum saving of 1.7 mgd. Following a bottle kit project in summer and fall 1973, involving plastic quart bottles for toilet flush water displacement and dye for making leak checks, water consumption dropped further to 97.0 gpcd. This was a 4.42% reduction from the minimum projected average daily consumption of 122.2 mgd without the conservation program. In addition, sewage flows from the WSSC service area in late 1973 and 1974 dropped well below the levels of 1973-74; flow decreased from 128.5 mgd in September 1972 to 120.6 mgd in September 1973 and 114.44 mgd in August 1974. After preliminary flier and spot announcements in 1970, a water-saving idea contest launched late in 21971 resulted in publication and distribution of handbooks on water conservation to some 370,000 customer services and apartment dwellers. Subsequent projects from 1971-73 were water-saving workshops and slide presentations, a water-saving fixture list, public service announcements, an appliance testing program, and plumbing code changes. (Lynch-Wisconsin)
W78-05752

URBAN STORM WATER MANAGEMENT,
For primary bibliographic entry see Field 5G.
W78-05821

DOMESTIC WASTEWATER RECYCLING.
For primary bibliographic entry see Field 5D.
W78-05864

THE IMPACT OF WATER SAVING WATER CLOSETS ON BUILDING DRAINS AND SEWERS,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
W. E. Sharpe, and C. A. Cole.
Plumbing Engineer, Vol. 5, No. 6, p 20-21, 60, November-December, 1977. 4 tab, 6 ref.

Descriptors: *Sewage disposal, *Drainage systems, *Plumbing, *Waste water disposal, *Water conservation, Pipelines, Sewerage, Water consumption, Sanitary engineering.

The effect of the use of water-saving toilets on drainage and sewage systems has been evaluated. Water closets with discharges ranging 0.25-5.25 gallons per flush were compared in terms of solid sewage velocity, sewer pipe diameter, sewer pipe slope, and depth of flow. The average water-saving water closet discharges 3.5 gallons per flush. Necessary velocities for the transport of solid sewage were calculated as 1.5-2.0 ft/sec. The velocity for a water-saving toilet with a discharge of 3.50 gallons per flush was discovered to be 1.88 ft/sec. This velocity was considered adequate for sewage transport. The depth of flow was considered a potential problem in the use of water closets with a discharge of less than two gallons per flush. Large scale installation of low flow water closets in a Pennsylvania resort did not present adverse effects to the sewage system, although detailed data was not available. (Lisk-FIRL)
W78-05904

3E. Conservation In Industry

THE WELMM APPROACH TO ENERGY STRATEGIES AND OPTIONS,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 6A.
W78-05704

ARE NATURAL RESOURCES CAPITAL USING A MICROANALYTIC APPROACH,
Tulane Univ., New Orleans, LA.
For primary bibliographic entry see Field 6C.
W78-05732

THIS PLANT MARRIES TWO WASTES,
Wiley and Wilson, Inc., Lynchburg, VA.
For primary bibliographic entry see Field 5D.
W78-05845

THE DEVELOPMENT OF HETEROTROPHIC BACTERIA IN CIRCULATING WATER SYSTEMS, (IN RUSSIAN),
Vsesoyuznyi-Nauchnyi Planovii Otdel Tsellyulozno-Bumazhnoi Promyshlennost, Leningrad (USSR).
For primary bibliographic entry see Field 5C.
W78-05893

CONCEPTS AND TECHNIQUES FOR EVALUATION OF ENERGY-RELATED WATER PROBLEMS,
Florida Univ., Gainesville. Center for Wetlands.
For primary bibliographic entry see Field 6A.
W78-05940

PHOTOSYNTHESIS AND SOLAR ENERGY CONVERSION,
Cornell Univ., Ithaca, NY. Div. of Biological Sciences.
For primary bibliographic entry see Field 8C.
W78-05969

WATER RECYCLING FLOW SCHEME FOR TOMATO PROCESSING PLANT CONTROLS SOIL ACCUMULATIONS,
For primary bibliographic entry see Field 5D.
W78-06067

SPRAY DRYING TECHNIQUES FOR BY-PRODUCT RECOVERY,
Niro Atomizer, Soeborg (Denmark).
For primary bibliographic entry see Field 5D.
W78-06068

HEAT RECOVERING INCINERATION OF ORGANIC EMISSIONS SAVES $970/000/YR IN FUEL COSTS,
Amoco Chemicals Corp., Joliet, IL.
For primary bibliographic entry see Field 5E.
W78-06072

DYEBATH REUSE IN BATCH DYEING,
George Inst. of Tech. Atlanta. School of Textile Engineering.
For primary bibliographic entry see Field 5D.
W78-06081

OFF-PEAK HOUR PUMPING RATE REDUCTION: ARE THE BENEFITS WORTH THE COSTS,
Boyle Engineering Corporation, Ventura, CA.
For primary bibliographic entry see Field 6B.
W78-06134

3F. Conservation In Agriculture

ECONOMIC ANALYSIS OF IRRIGATION PRODUCTION FUNCTIONS: AN APPLICATION OF LINEAR PROGRAMMING,
International Bank for Reconstruction and Development, Washington, DC. Development Research Center.
C. Pomareda.
Water Resources Bulletin, Vol 14, No 1, p 24-34, February 1978. 1 fig, 4 tab, 9 ref.

Descriptors: *Economic analysis, *Irrigated agriculture, *Linear programming, *Water utilization, *Production function, Optimization, Resource allocation, Profit maximization, Farm model, Constraints, Crops, Mathematical models, Equations, Systems analysis.

For estimating the yield response to irrigation water, good and varied information is available; however little and only partial (for individual crops) economic analysis has been made of this information. Herein, the economic analysis of irrigation production functions is discussed and a modified separable linear programming model is used for examining optimal levels of water use when, at the farm level, various crops with different water response functions compete for the same scarce resource. The effects of alternative water availabilities on the optimal levels of water use are explored using a multicrop farm model in which, in principle, the full water response function for each crop can be included. The farm objective function is specified as the maximization of profits from various crops, given a restriction in the availability of water and other inputs. This method provides advantage over the partial one-crop type of analyses because it captures intercrop tradeoffs in water and land use in response to economic policies or changes in water supply. (Bell-Cornell)
W78-05714

POLICY OF PRICING IRRIGATION WATER,
Ministry of Agriculture and Irrigation, New Delhi (India).
J. K. Jain.
ICID Bulletin, Vol. 26, No. 1, p 41-49, January 1977. 2 tab, 14 ref.

Descriptors: *Pricing, *Water policy, *Irrigation, *Water rates, *India, Economics, Governments, Cost-benefit analysis, Economic development, Developing countries, Economic impact, Political constraints, Subsidization, Crop production, Agriculture, Water management(Applied), Cost recovery.

Based on analysis of irrigation water pricing issues and theory, a guideline is suggested for formulating governmental pricing policy and its application is described for India. Major aspects are: (1) Subsidies up to 50% may encourage irrigation use and minimize inflation in the initial stages of irrigation development. (2) Assessment may be based on crop area in the interests of practicality and convenience but volumetric pricing should be promoted wherever possible, especially on tube wells. (3) In areas where farmers are not yet accustomed to irrigation, a two-part tariff may be introduced in place of the simpler single charge based on crop area. (4) Irrigation rates should be uniform unless there are strong reasons to introduce variable rates, such as variations in climate, soil, irrigation systems, crop irrigation requirements, or utilization of irrigation potential. Pre-independence Indian pricing policy was based on strict adherence to financial return, but since 1947 this criterion was initially relaxed and subsequently replaced by a cost-benefit standard in order to achieve rapid development of irrigation. The result was very low water rates, heavy government subsidization, and considerable diversity in the fixing of rates. Recent through on pricing is reviewed, with attention to quantum of water rates, mode of assessment, water rate structure, and water rate uniformity/diversity. (Lynch-Wisconsin)
W78-05730

RATIONALISATION OF IRRIGATION RATES IN A DEVELOPING COUNTRY,
Central Water Commission, New Delhi (India).
C. V. Gole, V. N. Amble, and M. M. L. Chopra.
ICID Bulletin, Vol. 26, No. 1, p 31-40 and 49, January 1977. 1 tab, 6 ref.

Descriptors: *Developing countries, *India, *Irrigation, *Water policy, *Water rates, *Pricing, Water management(Applied), Costs, Cost recovery, Economic development, Economic impact, Agriculture, Crop production, Cost-benefit analysis, Benefit sharing, Benefits, Governments, Economics.

Current methods of fixing irrigation rates in India's 18 states and regions as well as in several foreign countries are analyzed, and criteria are proposed for formulating a rational rate structure for India. The irrigation rate system adopted must balance two opposing goals: (1) recover costs and a portion of the benefits, but (2) provide the producer with incentive for increasing production through greater use of irrigation. It is concluded that: (1) Great variation exists among the Indian states and regions in irrigation rate-setting policy, with rates fixed largely on an ad-hoc basis. (2) At the beginning of a new irrigation project it may be necessary to limit cost recovery to annual operation and maintenance expenses in order to promote irrigation use. (3) In later stages rates should be increased to recover part of the interest charges and depreciation on invested capital. (4) Cost of nonstate irrigation sources should be considered in setting minimum state rates; (5) Benefits derived by irrigators should be measured as the excess of net benefits with irrigation compared with net benefits before irrigation. (6) As an interim measure, rates should be assessed on the basis of gross income from irrigated crops until data are available for net benefit determination. (7) Rate assessment based on volumetric supply is scientific and ensures optimum water use, but administration costs are prohibitively high. (8) Rates should be uniform over broad geographical areas. Several additional considerations are discussed. (Lynch-Wisconsin)
W78-05731

DEVELOPMENT OF A VERSION OF STANFORD MODEL AND ITS EVALUATION FOR STREAMFLOW SYNTHESIS FROM SMALL WATERSHEDS IN WEST VIRGINIA,
West Virginia Univ., Morgantown. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2E.
W78-05808

WATER USE RATES FOR RURAL WATER SYSTEMS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W78-05809

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

MEASURING CONSUMER SURPLUS BENEFITS OF WATER SUPPLY EXTENSIONS IN DEVELOPING COUNTRIES,
Texas Univ. at Dallas, Richardson.
For primary bibliographic entry see Field 6D.

W78-05710

REGIONAL WATER SUPPLY PLANNING BY INTERACTIVE SYSTEMS ANALYSIS,
Army Engineer District, Sacramento, CA.
P. E. Pugner, and T. C. Hughes.
Water Resources Bulletin, Vol 14, No 1, p 157-168, February 1978. 3 fig, 1 tab, 5 ref.

Descriptors: *Water supply, *Planning, *Mixed integer programming, *Computer programs, *Computer models, Cost minimization, Optimization, Regional analysis, Sensitivity analysis, Interactive, Systems analysis, Reservoirs, Treatment facilities, Data flow, Methodology.

Described is an interactive data and model generator that is intended to bridge the gap between the water resource engineer and planner and the mathematical programming systems approach to regional water supply planning. The procedure involves the use of: (1) a model generating program called GAMMA which is available as an addition to the Burroughs TEMPO mathematical programming package on B6700 computer systems; (2) a series of subroutines which obtain problem input data from the user; and (3) a series of computer control statements which link the subroutines, the data generator, and the mathematical programming package in order to obtain the optimal solution without requiring programming or modeling expertise from the user. The optimization objective is to minimize total annual cost with respect to capital investment and operation and maintenance costs. The matrix generator formulates the necessary hydrologic, demographic and stochastic water supply data input by the user into the format of a mixed integer linear programming problem for system optimization. The interactive program guides the user through the input and optimization segments, totally eliminates the chore of manually structuring the model matrix, and helps to eliminate errors. A hypothetical, sample problem is used to illustrate application of the methodology. (Bell-Cornell)
W78-05712

PROGRAMMER'S AND USER'S MANUAL FOR THE TRIBUTARY WATER QUALITY MODEL (FINAL REPORT ON PHASE 2),
Center for the Environment and Man, Inc., Hartford, CT.
For primary bibliographic entry see Field 5B.
W78-05717

A STUDY OF APPLICATION OF REMOTE SENSING TO RIVER FORECASTING, VOLUME II.
IBM Federal Systems Div., Huntsville, AL.
Available from the National Technical Information Service, Springfield, VA 22161 as N75-25265, Price codes: A18 in paper copy, A01 in microfiche. IBM No 75W00056. Final Report. (1975). Volume II - Detailed Technical Report: NASA-IBM Streamflow Forecast Model User's Guide. NASA-CR-143859. 409 p, 15 fig, 20 tab, 26 ref, 3 append.

Descriptors: *Remote sensing, *River forecasting, *Streamflow, *Computer models, Hydrologic aspects, Hydrologic data, Parametric hydrology, Simulation analysis, Watersheds(Basins), Computer programs, Optimization, Equations, Systems analysis.

This volume is intended to aid prospective users in operating the NASA-IBM Streamflow Forecast Model. Included are data preparation, determining model parameters, initializing and optimizing parameters (calibration), selecting control options, and interpreting results. Background material is given; appendices contain a dictionary of variables, a source program listing and flow charts. The model has been operated for this study on an IBM System/360 Model 44, using a Model 2250 keyboard/graphics terminal for interactive operation. The model can be set up and operated in a batch processing mode on any System/360 or 370 that has the memory capacity. The models described herein have evolved from the well-known Stanford Watershed Models. Modifications introduced by IBM under NASA contract consist mainly of adding routines for man-machine interfaces, multi-year simulations, statistical analysis of results, and plot output options. Shortened variable simulation periods have been introduced for forecast applications. (Bell-Cornell)
W78-05719

A MATHEMATICAL MODEL FOR THE ANALYSIS OF MULTI-RESERVOIR FLOOD CONTROL SYSTEMS,
Natal Univ., Durban (South Africa).
J. S. Windsor.
In: Mathematical Models for Environmental Problems. Proceedings of the International Conference, University of Southampton, England, September 8-12, 1975. C.A. Brebbia (Ed.), Southampton University. John Wiley & Sons, N.Y., N.Y., p 87-98, 1976. 3 fig, 3 ref.

Descriptors: *Reservoir operation, *Flood conrol, *Mixed integer programming, *Methodology, *Optimization, *Design, Economic efficiency, Cost minimization, Constraints, Linear programming, Decision making, Reservoir storage, Mathematical models, Equations, Operations research.

A methodology is presented which employs mixed integer programming to derive the least-cost design and operation alternatives for a multi-reservoir flood control system. At the first level of optimization, it is assumed that the nonlinear cost functions for the reservoirs and damage centers are known and that the flood variability at all significant points within the system is accounted for by using representative sets of recorded or synthetically derived flood hydrographs. At the second level, a short-run optimization model is designed to permit regulation of the entire system on a strictly foresight basis. This is accomplished by subdividing the flood period into shorter operational periods and updating the system release schedule as more information becomes available regarding the changing runoff and climatic conditions. This approach recognizes component interaction in space and time and therefore offers a potentially powerful method for the analysis of integrated flood control systems involving a large number of interdependent decision variables. (See also W78-05720) (Bell-Cornell)
W78-05721

A STOCHASTIC MODEL OF LEVEE FAILURE,
Eotvos Lorand Univ., Budapest (Hungary). Dept. of Numerical Methods.
For primary bibliographic entry see Field 8D.
W78-05724

A WATER QUALITY OPTIMIZATION MODEL FOR NONSERIAL RIVER SYSTEMS,
Calgary Univ. (Alberta).
For primary bibliographic entry see Field 5B.
W78-05725

SELECTING ALTERNATIVES IN WATER RESOURCES PLANNING AND THE POLITICS OF AGENDAS,
Johns Hopkins Univ., Baltimore, MD.
For primary bibliographic entry see Field 6B.
W78-05736

ENVIRONMENTAL PROTECTION GUIDELINES FOR CONSTRUCTING PROJECTS,
East Bay Municipal Utility District, Oakland, CA.
For primary bibliographic entry see Field 6G.
W78-05742

MOSQUITOES OF MIDDLE AMERICA,
California Univ., Los Angeles.
J. N. Belkin.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A035 346, Price codes: A03 in paper copy, A01 in microfiche. Report No. 12, U.S. Army Medical Research and Development Command, Washington, D.C., September 1976. 29 p, 55 ref, 5 append. DA-49-193-MD-2478.

Descriptors: *Mosquitoes, *Middle America, *Insects, *Ecology, *Classification, *Systematics, Distribution, Animal populations, Human diseases, Invertebrates, Public health, Basic data collections.

The project 'Mosquitoes of Middle America,' begun in 1962, is a cooperative enterprise of the University of California at Los Angeles, the U.S. Army Medical Research and Development Command, and the U.S. National Institutes of Health. Although the study is concerned with detailed studies of the systematics, ecology, distribution, and vector potential of the mosquitoes of Central America, the West Indies, and adjacent North and South America, the principal objective is gathering of data for mosquito-borne disease control. The ultimate goal of publication of a multivolume monograph has not been realized, but much has been accomplished, including: (1) a methodology for collecting, rearing, and preserving specimens; (2) research procedures for taxonomic studies; (3) methods for illustration, presentation of data, and publications; (4) over 11,500 individual collections in all locations except Cuba; (5) over 86,000 individual rearings from larvae or pupae; (6) more than 400,000 specimens, including 284,700 slides of larvae, male genitalia, and adults; (7) seven installments of the Collection Records of the Projects; (8) a nearly complete file of reprints of taxonomic papers; and (9) data on the types of all nominal species described from the New World have been assembled, with types from Europe and South America studied in detail. Only about 25% of total existing mosquito species in the study area (261 named species) have treated in detail, but 55 studies have been published. (Lynch-Wisconsin)
W78-05743

HARVESTING A NUISANCE,
Florida Univ., Gainesville.
J. Queijo.
Environment, Vol. 19, No. 2, p 25-29, May 1977. 3 fig, 9 ref.

Descriptors: *Water hyacinth, *Aquatic weed control, *Beneficial use, *Sewage treatment, *Feeds, Harvesting, Biocontrol, Mechanical control, Chemcontrol, Southeast US, Proteins, Nutrients, Nitrogen, Phosphorus, Herbicides, Nutrient removal, Water pollution control, Eichhornia crassipes.

While mechanical, chemical, and biological control efforts against water hyacinth (Eichhornia crassipes) continue, attention is now being directed to beneficial aspects of floating plant. Within ten years of its introduction into the United States at a New Orleans exposition in 1884, the plant had spread to North Carolina, South Carolina, Georgia, Alabama, Mississippi, and Florida. Still a major problem, water hyacinth will normally double in weight in 7-10 days, and ten plants can theoretically multiply to 600,000 in eight months. Dense mats clog waterways, cause suffocation of fish, and provide breeding grounds for disease-carrying mosquitoes and snails. Control efforts were begun in 1898 with a mechanical cropper; two years later the 35-year reign of the deadly sodium arsenite started, finally replaced in 1937 with use of a crusher boat. The herbicide 2,4-D, first used in the mid-1940s, to date is the most effective chemical control agent. Natural predators, including water hyacinth weevils and a water snail, are being tested. Water hyacinth can absorb nutrients and chemicals from sewage and industri-

al wastes at high rates, and a sewage treatment plant has been started in Mississippi using the plants to remove nitrogen and phosphorus, with production of methane and fertilizer as by-products. Research is underway to convert hyacinths into cattle feeds. Three kg dried hyacinth can supply a steer with daily nutritional requirements of calcium, phosphorus, potassium, magnesium, and sodium. (Lynch-Wisconsin)
W78-05745

INTERNATIONAL CO-OPERATION AND INLAND WATERS: THE INFLUENCE OF FEDERALISM,
United Nations Secretariat.
For primary bibliographic entry see Field 6E.
W78-05746

PROPAGATION AND USE OF SPARTINA ALTERNIFLORA FOR SHORELINE EROSION ABATEMENT,
North Carolina State Univ. at Raleigh.
W. W. Woodhouse, Jr., E. D. Seneca, and S. W. Broome.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A030 423, Price codes: A05 in paper copy, A01 in microfiche. Technical Report No. 76-2, Army, Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, Virginia, August 1976. 31 fig, 20 tab, 5 ref. G31530, DACW72-70-C-0015, DACW72-72-C-0012, DACW72-74-C-0014.

Descriptors: *Erosion control, *Spartina alterniflora, *Marsh plants, *Bogue Sound(NC), *Shore protection, *Vegetation establishment, Shoreline cover, *North Carolina, Waves(Water), Planting management, Nutrients, Marsh management, Coasts, Beach erosion, Transplanting.

Successful experiments were conducted to protect the eroding south shore of Bogue Sound, North Carolina by means of planktings of the marsh plant, Spartina alterniflora. The test area was located near Pine Knoll Shores, a residential development, and the Pine Knoll Shores Golf Course. During development a channel was dredged parallel to and about 100-150 ft offshore from the present high-tide line, and dredgings were deposited along waterfront lots, killing existing S. alterniflora vegetation. Shoreline erosion followed, and in 1973 a concrete bulkhead was installed just above the high-tide line. When erosion continued, planting experiments were begun in 1974. Results of the planting and laboratory nutrition experiments showed that: (1) A local plant stock was superior to plants grown locally from foreign seed during the first growing season, but such differences disappeared by the fourth year. (2) Rhizomes of S. alterniflora without attached, well-developed culms were worthless as propagules in the intertidal zone. (3) Neither fertilization in the nursery nor in the furrow at transplanting affected final establishment of vegetation on the shoreline. (4) Plants grown from seeds in peat pots were as successful as field-grown transplants, but were more expensive to produce and more difficult to transplant. (5) Seeding was unsuccessful on the shoreline because of wave action. Details of planting techniques are given. (Lynch-Wisconsin)
W78-05751

FLOOD PLAIN INFORMATION: MONONGAHELA, WEST FORK AND TYGART RIVERS, MARION COUNTY, WEST VIRGINIA.
Army Engineer District, Pittsburgh, PA.
Prepared for Marion County Planning Commission, June 1975, 34 p, 13 fig, 12 plates, 7 tab.

Descriptors: *West Virginia, *Streamflow forecasting, *Flood data, Floods, Flood flow, Indirect flood measurement, Maximum probable flood, Flood forecasting, Flood profiles, Historic floods, Flood frequency, Flood stages, Peak discharge, Stage-discharge relations, Flood damage, Flood protection, Non-structural alternatives, Warning systems, Land use, Planning, Control structures, Dams, Reservoirs, *Monongahela River(WV), *West Fork River(WV), *Tygart River(WV), Marion County(WV), 100-year flood, 500-year flood, Fairmont(WV), Rivesville(WV), Monongah(WV), Worthington(WV).

The study area involves the portions of Marion County, West Virginia that are subject to flooding by the Monongahela, West Fork, and Tygart Rivers. Included are the cities of Fairmont, Rivesville, Monongah, and Worthington. The flood plain consists mostly of a thin strip of land between the river and the railroad tracks and for the most part consists of undeveloped land, except in urban areas, where residential, commercial, and industrial land uses exist. Flood data were obtained from topographic maps, field studies, historical souces, and stream gage records. The main flood season occurs from December through March, and results from heavy general rainfall combined with snowmelt. Tygart Dam controls about 86% of the watershed, so there is rarely serious flooding on the Tygart River. It helps to reduce major flood crests in Marion County by 4-6 feet. Another flood control dam has been authorized for construction, but it would have little effect on Marion County. The worst flood recorded at the Fairmont gage on the Monongahela River occurred in March 1967, cresting at 27.9 feet mean sea level (msl) and discharging 65,400 cubic feet per second (cfs). At the same location, the 100-year flood would crest at 30.4 feet msl and would discharge 80,500 cfs, while the 500-year flood would crest at 34.1 feet msl and would discharge 98,700 cfs. Only 2 of 19 bridges would obstruct the 100-year flood flow. This study is intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC)
W78-05761

FLOOD PLAIN INFORMATION: WEST FORK RIVER AND ELK CREEK, CLARKSBURG AND VICINITY, HARRISON COUNTY, WEST VIRGINIA.
Army Engineer District, Pittsburgh, PA.
Prepared for Clarksburg Planning Commission, WV, March 1973, 37 p, 8 fig, 9 plates, 9 tab.

Descriptors: *West Virginia, *Streamflow forecasting, *Flood forecasting, *Flood data, *Flow characteristics, *Stage-discharge relations, Floods, Flood flow, Indirect flood measurement, Flood profiles, Historic floods, Flood stages, Peak discharge, Flood plains, Standard Project Flood, Flood protection, Non-structural alternatives, Warning systems, Land use, Planning, Control structures, Clarksburg(WV), Harrison County(WV), *West Fork River(WV), *Elk Creek(WV), Intermediate Regional Flood.

The study area includes West Fork River and Elk Creek, and their floodplains, in the vicinity of Clarksburg, Harrison County, West Virginia. The flood plain is largely developed, containing residential, commercial, and transportation land uses. Flood data were obtained from topographic maps, field studies, historical sources, and stream gage records. The main flood season occurs from December through May and results from heavy rain combined with snowmelt. Serious flooding may occur at any time. The worst flood recorded at the Clarksburg gage on the West Fork River occurred March 7, 1967. It crested at 946.22 feet mean sea level (msl) and discharged 17,800 cubic feet per second (cfs). At the same location, the Intermediate Regional Flood (IRF) would crest at 947.2 feet msl and would discharge 20,500 cfs, while the Standard Project Flood would crest at 952.4 feet msl and would discharge 30,000 cfs. Five of the ten bridges in the study area would interfere with these flood flows. A proposed flood control project upstream of Weston, WV, should reduce major floods at Clarksburg by one to two feet. Elk Creek, a major tributary of the West Fork River, enters at River Mile 31.65, flowing in a northwest direction through the study area. Historic and future flood profiles are also presented for Elk Creek. This study is intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC)
W78-05762

FLOOD PLAIN INFORMATION: LITTLE WHEELING CREEK, TRIADELPHIA TO VALLEY GROVE, OHIO COUNTY, WEST VIRGINIA.
Army Engineer District, Pittsburgh, PA.
Prepared for Wheeling-Ohio County Planning Commission, WV, October 1970, 22 p, 4 fig, 6 plates, 2 tab.

Descriptors: *West Virginia, *Streamflow forecasting, *Flood data, *Stage-discharge relations, Floods, Flood flow, Indirect flood measurement, Historic floods, Flood stages, Flood peak, Flood plains, Standard Project Flood, Flood protection, Non-structural alternatives, Land use, Planning, Control structures, Flood profiles, *Little Wheeling Creek(WV), Triadelphia District(WV), Valley Grove(WV), Ohio County(WV), Intermediate Regional Flood.

The study area involves Little Wheeling Creek and its flood plain within the limits of Triadelphia District and the towns of Triadelphia and Valley Grove in Ohio County, West Virginia, covering a stretch of about 8.5 miles. The flood plain contains many commercial, residential and industrial land uses. Flood data were obtained from topographic maps, historical sources, and short term stream gage records. The main flood season occurs from June through October and results from intense local rainfall. The worst known flood occurred in July 1937. Its magnitude was equivalent to the Intermediate Regional Flood (IRF). It crested at 693.0 feet mean sea level (msl) and discharged 18,000 cubic feet per second (cfs). At the same location, the Standard Project Flood would crest at 702.5 feet msl and would discharge 30,000 cfs. Twenty one of the 41 bridges crossing the stream in the study area would obstruct the IRF flow. This study is intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC)
W78-05763

FLOOD PLAIN INFORMATION: FULTON BRANCH, WEBSTER CREEK AND TRIBUTARIES, WAMAC, ILLINOIS.
Army Engineer District, St. Louis, MO.
Prepared for City of Wamac, IL, June 1977, 30 p, 10 fig, 19 plates, 5 tab.

Descriptors: *Illinois, *Flood flow, *Streamflow forecasting, *Flood data, Floods, Flood profiles, Historic floods, Flood frequency, Peak discharge, Stage-discharge relations, Flood plains, Flood protection, Non-structural alternatives, Land use, Planning, Control structures, *Fulton Branch(IL), *Webster Creek(IL), Wamac(IL), 100-year flood, 500-year flood.

The study area includes Fulton Branch and Webster Creek in the vicinity of Wamac, Illinois. The flood plains are mostly undeveloped or agricultural, with some residential land uses in Wamac. Flood data were obtained from topographic maps, historical sources, field studies, and rainfall intensity information. No stream gage records were available. Flooding may occur at any time of year and results from intense local rainfall. Data on historic floods are imprecise, but do indicate that the worst flood occurred in May 1961. At Township Road on Fulton Branch at the downstream study limit, the 100-year flood would discharge 2,800 cubic feet per second (cfs) and would crest at 467 feet mean sea level (msl), while the 500-year flood would discharge 3,850 cfs and

would crest at 467.3 feet msl. Numerous bridges would interfere with these flood flows. Historic and future flood profiles are provided for the rest of the study area. This study is intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC)
W78-05764

FLOOD PLAIN INFORMATION: SILVER CREEK AND TRIBUTARIES, ST. CLAIR COUNTY, ILLINOIS - NO. 1.
Army Engineer District, St. Louis, MO.
For primary bibliographic entry see Field 6F.
W78-05765

ANALYSIS OF HYDROLOGICAL RECESSION CURVES,
Commonwealth Scientific and Industrial Research Organization, Brisbane (Australia). Div. of Mathematics and Statistics.
For primary bibliographic entry see Field 2E.
W78-05769

TRANSPORT OF ATRAZINE AND SIMAZINE IN RUNOFF FROM CONVENTIONAL AND NO-TILLAGE CORN,
Ohio Agricultural Research and Development Center, Wooster.
For primary bibliographic entry see Field 5B.
W78-05782

WINTER FLOOD IN LENINGRAD ON DECEMBER 20, 1973,
For primary bibliographic entry see Field 2E.
W78-05800

COST OPTIMIZATION OF RURAL WATER SYSTEMS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W78-05810

ESTIMATION OF BENEFITS AND ANALYSIS OF FACTORS INFLUENCING LAND USE CHANGE IN THE IOWA RIVER FLOOD PLAIN,
Iowa Univ., Iowa City. Dept. of Economics.
For primary bibliographic entry see Field 6B.
W78-05811

OPTIMAL STATE ANALYSIS OF RESERVOIRS,
California Univ., Riverside. Dry Lands Research Inst.
W. W-G. Yeh, L. Becker, W. J. Trott, G. W. Tauxe, and L. F. Hancock.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 571, Price codes: A05 in paper copy, A01 in microfiche. Report No. UCLA-ENG-7390, November, 1973. 75 p, 2 fig, 2 tab, 32 ref, 2 append. OWRT C5184(4208)(1), Bur Reclam 14-06-200-5882A.

Descriptors: *Optimization, *Reservoirs, *Dynamic programming, *Least squares method, *Linear programming, Operations research, Sampling, Water utilization, Reservoir storage, Computer programs, Management, Streamflow, Bibliographies, California, Water policy, Methodology, *California Central Valley Project(CA), *Shasta Reservoir(CA), *Clair Engle Reservoir(CA).

A methodology for optimal state analysis of reservoirs was developed and applied to the reservoirs and hydroelectrical facilities associated with the Shasta, Trinity, and Folsom subsystems of the California Central Valley Project. With a typical requirement of real time, multiple reservoir operation, the methodology was evolved utilizing a form of dynamic programming for selection of an optimal reservoir storage policy path through a specified number of policy periods; a linear programming routine was used for period by period optimization. Relatively easy computer implementation and high flexibility resulted; the method is valuable for determination of release policies in real time operation of an existing system. A two-stage least squares estimation method is also presented to support optimization; it gives unbiased estimators when the system is described by a set of simultaneous equations in which each equation contains several dependent variables which also occur in other equations. Application was made to the forecasting of stream flows into the Shasta and Clair Engle reservoirs, showing that dependent variables are the February-July inflows and independent variables include snow water contents and precipitation indices at several stations within the watersheds. An annotated bibliography on the available practical techniques for considering adverse effects of daily/weekly operations on the risk of not meeting firm water and power commitments at some future date is included; the sparsity indicated the need for future research. Appendices contain programs for the linear-dynamic programming algorithm and for two-stages regression. (Wares-IPA)
W78-05817

SIMPLE METHODS FOR RAINFALL-RUNOFF-PROCESS. RUNOFF HYDROGRAPH CURVES FOR RAIN AND MIXED WATER CANALS (EINFACHE MODELLE FUER NIEDERSCHLAG-ABFLUSS-PROZESSE. AB-FLUSSGANGLINIEN FUER REGEN UND MISCHWASSERKANAELE),
For primary bibliographic entry see Field 5D.
W78-05823

ADEQUACY OF HYDROLOGIC DATA FOR APPLICATION IN WEST VIRGINIA,
West Virginia Univ., Morgantown. Water Research Inst.
For primary bibliographic entry see Field 7C.
W78-05931

DEVELOPMENT OF A SUBSURFACE HYDROLOGIC MODEL AND USE FOR INTEGRATED MANAGEMENT OF SURFACE AND SUBSURFACE WATER RESOURCES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
For primary bibliographic entry see Field 4B.
W78-05934

THE WHITE AMUR AS A BIOLOGICAL CONTROL FOR AQUATIC WEEDS IN INDIANA,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
C. A. Lembi, and B. G. Ritenour.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 611, Price codes: A06 in paper copy, A01 in microfiche. Technical Report No 95, December 1977. 95 p, 8 fig, 15 tab, 54 ref, 3 append. OWRT A-032-IND(1).

Descriptors: *Aquatic weed control, Aquatic plants, *Aquatic algae, Fresh water algae, Plankton, Dragonflies, Diptera, Midges, Zooplankton, Weed control, Phosphorus, Potassium, Dissolved oxygen, Nitrogen, *Biocontrol, *Indiana, *White amur, *Grass carp, *Biological weed control, Spirogyra, Watermilfoil, Myriophyllum, Ceratophyllum, Potamogeton, Najas, Elodes, Lemna, Wolffia.

Water quality parameters, plankton, and benthic invertebrates in ponds stocked with white amurs (Ctenopharyngodon idella Val.) and in control ponds were compared during the summers of 1975 and 1976. Amurs rapidly consumed available aquatic vascular plants. The filamentous green alga, Spirogyra, was the least desired. Dissolved oxygen levels in amur ponds remained high as long as bottom growths of Spirogyra were present, but consumption of this alga in addition to vascular vegetation led to significantly lower oxygen concentrations in the water directly above the sediments. The other parameters consistently affected during the 2 year study were turbidity and potassium concentration; both were significantly higher in amur ponds. Potassium in the water appeared to be an excellent indicator of vegetation consumption. In laboratory studies, amurs and large mouth bass were exposed to varying concentrations of rotenone. Results indicated that amurs can not be selectively removed from a fish population containing largemouth bass.
W78-05936

INTERFEROMETRIC OBSERVATIONS OF THE TEMPERATURE STRUCTURE IN WATER COOLED OR HEATED FROM ABOVE,
Purdue Univ., Lafayette, IN. Heat Transfer Lab.
For primary bibliographic entry see Field 2D.
W78-05942

ESTIMATES OF LOW FLOWS USING WATERSHED AND CLIMATIC PARAMETERS,
Stephen F. Austin State Univ., Nacogdoches, TX. School of Forestry.
For primary bibliographic entry see Field 2E.
W78-05944

GENERATING RAINFALL EXCESS BASED ON READILY DETERMINABLE SOIL AND LAND-DUSE CHARACTERISTICS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2A.
W78-05945

UTILIZATION OF SATELLITE DATA FOR INVENTORYING PRAIRIE PONDS AND LAKES,
Environmental Research Inst. of Michigan, Ann Arbor.
For primary bibliographic entry see Field 2H.
W78-05979

UTAH LAKE-JORDAN RIVER BASIN MODELING PROJECT. VOLUME I. SUMMARY REPORT. VOLUME II. APPENDIX.
Environmental Dynamics Inc., Los Angeles, CA.
For primary bibliographic entry see Field 5B.
W78-05983

SHOULD DAMS BE BUILT. THE VOLTA LAKE EXAMPLE,
United Nations Environment Program, Nairobi (Kenya).
For primary bibliographic entry see Field 5C.
W78-06033

CASE STUDY: THE SANTEE RIVER, S.C.,
South Carolina Univ., Columbia.
For primary bibliographic entry see Field 5C.
W78-06055

HYDROLOGIC AND ENVIRONMENTAL EFFECTS OF A LONG-TERM DRAINAGE ON A COASTAL AREA, (CASE STUDY: MELBOURNE TILLMAN DRAINAGE DISTRICT, PALM BAY, FLORIDA),
Florida Inst. of Tech., Melbourne. Center for Coastal Zone Research.
For primary bibliographic entry see Field 2L.
W78-06057

INLAND WETLAND DEFINITIONS,
Connecticut Univ., Storrs. Biological Sciences Groups.
For primary bibliographic entry see Field 2H.

W78-06083

A GUIDE TO UNDERSTANDING AND ADMINISTRATING THE MASSACHUSETTS WETLANDS PROTECTION ACT.
Massachusetts Audubon Society, Lincoln.
For primary bibliographic entry see Field 6E.
W78-06084

FORESTS AND WATER: EFFECTS OF FOREST MANAGEMENT ON FLOODS, SEDIMENTATION, AND WATER SUPPLY,
Pacific Southwest Forest and Range Experiment Station, Berkeley, CA.
For primary bibliographic entry see Field 4C.
W78-06089

THE ANALYSIS OF MULTIVARIATE TIME SERIES APPLIED TO PROBLEMS IN HYDROLOGY,
International Inst. of Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 2E.
W78-06102

STATISTICAL METHODS IN HYDROLOGY,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 7C.
W78-06125

WATER RESOURCES DATA FOR OKLAHOMA, WATER YEAR 1975.
Geological Survey, Oklahoma City, OK. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-06175

WATER RESOURCES DATA FOR UTAH, WATER YEAR 1975.
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-06176

WATER RESOURCES DATA FOR MONTANA, WATER YEAR 1976.
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-06177

PUBLIC WATER SUPPLIES OF NORTH CAROLINA, PART 5. SOUTHERN COASTAL PLAIN,
Geological Survey, Raleigh, NC. Water Resources Div.
T. M. Robison, and L. T. Mann, Jr.
North Carolina Department of Natural Resources and Community Development, Raleigh, July 1977. 333 p, 5 fig, 13 ref.

Descriptors: *Water supply, *North Carolina, *Water sources, *Surface waters, *Groundwater, Water works, Water quality, Water treatment, Water utilization, Water users, Water storage, Water management(Applied), Appraisals, Water resources development, Southern Coastal Plain(NC), Counties.

This report contains information on the water resources and the larger public water supplies in 17 counties in the southern Coastal Plain section of North Carolina for the use of planners and water managers concerned with water-supply availability, water-resources development, and water quality. The report is divided into two sections. The first describes the method of investigation, an explanation of the information reported for each water supply and its significance to planning, a discussion of the chemical analyses included in the report, and a discussion of some of the problems noted during the investigation. The second includes a water-resources appraisal and a map of each county showing the general area served by public water supplies and an inventory of each public supply in the county with 500 or more customers. Water supplies for large military bases have been included in the study. Data presented in the second section includes: (1) the population served, (2) the adjacent communities served, (3) the number of customers, (4) the source of water, (5) estimated allowable draft, (6) total and industrial water use, (7) raw- and finished-water storage, (8) raw- and finished-water pumping capacity, (9) future plans, (10) a water-resources appraisal in the immediate vicinity of the supply and, (11) the results of chemical analyses of raw and finished water. (Woodard-USGS)
W78-06178

SELECTED HYDROLOGIC DATA, PAROWAN VALLEY AND CEDAR CITY VALLEY DRAINAGE BASINS, IRON COUNTY, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-06180

REPORT OF THE RIVER MASTER OF THE DELAWARE RIVER FOR THE PERIOD DECEMBER 1, 1975 -- NOVEMBER 30, 1976,
Geological Survey, Reston, VA. Water Resources Div., and Geological Survey, Milford, PA. Water Resources Div.
F. T. Schaefer, and R. E. Fish.
Report of the River Master of the Delaware River for the Period Dec 1, 1975 -- Nov. 30, 1976, (USGS, Reston, Va.), 1977. 91 p, 5 fig, 1 plate, 18 tab.

Descriptors: *Reservoir operation, *Delaware River, *Reservoir storage, *Reservoir releases, *Water quality, New Jersey, New York, Pennsylvania, Hydrologic data, Streamflow, Flow control, Hydrologic budget, Water supply, Water distribution(Applied), Diversion, Estuaries, Water analysis, Saline water intrusion.

The report on the hydrologic and hydraulic operations of the Delaware River basin is for the year ending November 30, 1976. This marks the twenty-third year of such activities since the inception of the Amended Decree of the United States Supreme Court, dated June 7, 1954. Hydrologic conditions in the Delaware River basin during the year were generally in the above-normal range. Diversions from the basin to New York City and to New Jersey were below limits authorized in the Decree. Releases from reservoirs were made as prescribed under the Decree. During the first half of the report year, December to May, precipitation that was slightly above average resulted in stream runoff slightly above median. Runoff of the Delaware River at Montague was the highest of record for February. Cannonsville Reservoir spilled throughout the period, Pepacton Reservoir spilled during every month, and Neversink Reservoir did not spill. During the summer and fall, part of the storage and inflow to the New York City reservoirs was required for diversions and releases. Diversions to Rondout Reservoir during June 1 to November 30 totaled 135,398 billion gallons. During June 1-14, the flow required to be maintained in the Delaware River at Montague was the minimum basic rate of 1,750 cfs and the forecasted discharge exclusive of releases from Papacton, Cannonsville, and Neversink Reservoir was greater than 1,750 cfs each day. On June 15, the seasonal period began for release of the excess quantity of water from the reservoirs, and the design rate to be maintained at Montague became 2,160 cfs. Data are presented for water quality of the Delaware River Estuary between Trenton, N.J. and Ship John Shoal Lighthouse, N.J. (Woodard-USGS)
W78-06181

SEDIMENTATION IN SANTA MARGARITA LAKE, SAN LUIS OBISPO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2J.
W78-06182

WATER RESOURCES INVENTORY OF NORTHWEST FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 6D.
W78-06183

HYDROLOGY AND WATER QUALITY OF THE ATCHAFALAYA RIVER BASIN,
Geological Survey, Baton Rouge, LA. Water Resources Div.
F. C. Wells, and C. R. Demas.
In Cooperation with Louisiana Department of Transportation and Development, Baton Rouge, Office of Public Works, Water Resources Technical Report No 14, 1977. 53 p, 22 fig, 1 plate, 9 tab, 19 ref.

Descriptors: *Streamflow, *Discharge(Water), *Water quality, *Sediment transport, *Louisiana, Gaging stations, Flow rates, Tracking techniques, Path of pollutants, Dye releases, Tracers, Water analysis, Chemical analysis, Inorganic compounds, Water temperature, Dissolved oxygen, Nutrients, Pesticides, Bacteria, Heavy metals, Hydrologic data, *Atchafalaya River basin(La), Time of travel.

The Atchafalaya River in Louisiana receives its water from the Red River, the Black River, and the Mississippi River by way of the Old River Control Structure. Ninety-five percent of the time the Mississippi River supplies at least 50 percent of the flow of the Atchafalaya River at Simmesport, La. Since completion of the Old River Control Structure, approximately 30 percent of the flow of the Mississippi River is diverted to the Atchafalaya River. Since 1964, the 50-percent flow duration (median flow) of the Atchafalaya River has increased from 140,000 to 190,000 cfs. The average suspended-sediment load transported past Simmesport, La., is 260,000 tons per day. The median suspended-sediment load is 150,000 tons per day. The maximum recorded suspended-sediment load was 2,120,000 tons per day (March 1968), and the minimum suspended-sediment load was 3,000 tons per day (November 1964). The chemical quality of the Atchafalaya River is controlled by the discharge and chemical quality in the Red, Black, and Mississippi rivers. The dominant anion and cation present in the Atchafalaya River at Simmesport are bicarbonate and calcium, respectively. Tracer studies were made during a relatively low-flow period, 137,000 cfs in August 1975. The tracer was injected into the Atchafalaya River approximately 1 mile below the confluence of the Red River and Old River outflow channel. Complete lateral mixing was first observed at Melville, approximately 32 miles below the injection site. (Woodard-USGS)
W78-06184

BED CONDUCTION COMPUTATION FOR THERMAL MODELS,
Geological Survey, Bay St. Louis, MS. Water Resources Div.
For primary bibliographic entry see Field 8B.
W78-06185

A TECHNIQUE FOR DETERMINING DEPTHS FOR T-YEAR DISCHARGES IN RIGID-BOUNDARY CHANNELS,
Geological Survey, Menlo Park, CA. Water Resources Div.
D. E. Burkham.
Water-Resources Investigations 77-83, December 1977. 38 p, 6 fig, 2 tab, 7 ref.

Descriptors: *Floods, *Channel flow, *Depth-area-duration analysis, *Streamflow forecasting, Natural streams, Hydraulics, Analytical techniques, Flood frequency, Discharge(Water), Depth, Roughness(Hydraulic), Flood profiles, Flood plain zoning, 100-year discharge, Simplified flood-mapping techniques, Federal Insurance Administration flood studies.

A simplified technique is presented for determining depths for T-year discharges (the discharge that will occur, on an average, once in T-years--10 years, 50 years, 100 years) for natural channels (channels not significantly affected by manmade structures) having channel-control conditions and rigid boundaries (channels having a low probability of change that would significantly affect the hydraulic characteristics of a T-year discharge). Channel-control conditions usually exist during T-year discharges in natural rigid-boundary channels and, therefore, the simplified technique probably would be applicable for flood-inundation studies for many natural rigid-boundary channels. The technique requires that the T-year discharge for a reach be known or readily available; also, a channel-shape factor, a width at a reference altitude, a channel-bottom slope (or a water-surface slope), and the Manning's roughness factor, n, must be estimated or determined at representative sections having channel-control conditions. The standard error of estimate for depths determined according to the simplified technique is probably 25-30 percent. In comparison, the standard error of estimate for the depths determined according to the step-backwater procedure and to guidelines and specifications for flood-insurance studies of the Federal Insurance Administration is about 23 percent. (Woodard-USGS)
W78-06189

WATER RESOURCES OF NO NAME VALLEY, COLVILLE INDIAN RESERVATION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W78-06194

4B. Groundwater Management

SUPPLEMENTAL COLORADO RIVER WATER FOR A DEVELOPED GROUNDWATER AGRICULTURE: A PROBLEM OF QUANTITIES, QUALITIES AND CONJUNCTIVE USE,
Fish and Wildlife Service, Washington, DC. Office of Biological Services.
M. A. Boster, and W. E. Martin.
Advances in Water Resources, Vol 1, No 2, p 103-109, December 1977. 11 ref, append.

Descriptors: *Colorado River, *Groundwater development, *Water importing, *Irrigated agriculture, *Linear programming, *Conjunctive use, Surface waters, Water quality, Farms, *Arizona, Costs, Salinity, Projects, Optimization, Benefit maximization, Economic efficiency, Crop yield, Mathematical models, Systems analysis.

Upon completion of the Central Arizona Project, Colorado River water will be delivered some 200 miles inland for agricultural, domestic, and industrial use. Any new importation of water to an area implies adjustments in the organization of the economy of the area. For irrigated agriculture, adjustments will occur in input mix, output mix, acreage farmed, and in gross and net incomes. A complicating factor associated with importation of Colorado River water is that the imported water will contain different dissolved salt concentrations than the groundwater and surface water currently being used. Linear programming models of representative irrigated farms in Pinal County, Arizona are used to project adjustments implied under several assumptions as to the availability, cost and salinity of the various sources of irrigation water. The models are designed to maximize net farm returns above variable production costs subject to the resource constraints faced by the representative farmers. Conclusions are drawn as to the potential winners and losers from project development: Increased salinity should not be of concern to the farmers in the county and Indian farms will reap the greatest share of benefits from the Project. (Bell-Cornell)
W78-05705

COMPUTER MODELLING OF GROUNDWATER 13C AND 14C ISOTOPE COMPOSITIONS,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2F.
W78-05767

DETERMINATION OF UNIFORM AND GRANULAR AQUIFER CHARACTERISTICS BY LINEAR METHODS,
Gerede Sokat, Ankara (Turkey).
For primary bibliographic entry see Field 2F.
W78-05775

IMPACT OF LAND USE ON GROUND WATER QUALITY IN THE GRAND TRAVERSE BAY REGION OF MICHIGAN,
Duke Univ., Durham, NC. School of Forestry and Environmental Studies.
For primary bibliographic entry see Field 5A.
W78-05778

CHARACTERISTICS OF THE INTERRELATION OF SURFACE AND GROUND WATERS IN THE KARAKENGIR RIVER BASIN WITH A DISTURBED NATURAL REGIME,
For primary bibliographic entry see Field 2F.
W78-05794

UNDERGROUND INJECTION OF LIQUID WASTE CAN BE ENVIRONMENTALLY SOUND,
Texas Water Quality Board, Austin.
For primary bibliographic entry see Field 5E.
W78-05899

APPLICATION OF HEAT-FLOW TEMPERATURE MODEL FOR REMOTELY ASSESSING NEAR SURFACE SOIL MOISTURE BY THERMOGRAPHY,
South Dakota State Univ., Brookings. Dept. of Physics.
For primary bibliographic entry see Field 2G.
W78-05932

HYDROGEOLOGY OF THE LAKE METIGOSHE BASIN NORTH DAKOTA AND MANITOBA,
North Dakota Univ., Grand Forks. Dept. of Geology; and Geological Survey, Grand Forks, ND.
For primary bibliographic entry see Field 5B.
W78-05933

DEVELOPMENT OF A SUBSURFACE HYDROLOGIC MODEL AND USE FOR INTEGRATED MANAGEMENT OF SURFACE AND SUBSURFACE WATER RESOURCES,
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.
H. J. Morel-Seytoux.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 629, Price codes: A03 in paper copy, A01 in microfiche. Environmental Resources Center, Fort Collins, Colorado Water Resources Research Institute, Completion Report No 82, December 1977. 27 p, 11 fig, 2 tab, 13 ref. OWRT B-144-COLO(6). 14-34-0001-6064.

Descriptors: *Conjunctive use, *Model studies, River basin management, Surface water, Groundwater, Aquifer management, Subsurface water, Water management(Applied), *Simulation analysis, Return flows, Drawdown, Cost effeciencies, *Colorado, *South Platte River(Colo).

Two new concepts useful in studies of conjunctive management of surface and ground waters are introduced. In order to model both accurately and cost-effectively the effect of initial aquifer drawdowns on the future state of the system, artificial pumping rates for one period prior to the initial time are introduced. With this approach it is possible to simulate the effect of initial conditions in the same way pumping effects are predicted. In addition, for long-term simulation the concept of sequential reinitialization is introduced. In this manner daily simulation over many years can be carried with pumping and relaxation discrete kernels calculated for only a few periods. The concept of reach transmissivity introduced in earlier studies is verified by comparison with observations of return flows to a reach of the South Platte River. The study indicates the approach is sound.
W78-05934

A PUMP TEST IN THE DAKOTA SANDSTONE AT WALL, SOUTH DAKOTA,
South Dakota School of Mines and Technology, Rapid City. Dept. of Geology and Geological Engineering.
J. P. Gries, P. H. Rahn, and R. K. Baker.
South Dakota Geological Survey, Vermillion, 1976. Circular 43, 8 fig, 11 ref. OWRT A-034-SDAK(2).

Descriptors: *Wells, *Pumping, *Testing, *South Dakota, Water wells, Drawdown, Sandstones, Groundwater, Aquifers, Aquifer testing, Groundwater availability, Geology, Geologic formations, Water resources, Water supply, *Wall(SD), *Dakota sandstones, Pump tests.

A pump test was conducted in the Dakota Sandstones at Wall, South Dakota, on October 7, 1972. Two observation wells responded to the pumping, and an average value of permeability was calculated to be 9.42 gpd/sq ft. No deviation from the Theis type curve was observed during the 44 hours of pumping at 120 gpm. (Sims-ISWS)
W78-05946

EFFECT ON GROUNDWATER OF INFILTRATION AND WASTE WATER TREATMENT NEAR ANN, JAMTLAND COUNTY, (IN SWEDISH),
Chalmers Univ. of Technology, Goteborg (Sweden). Vatten Inst. Tek.
For primary bibliographic entry see Field 5B.
W78-06028

THE BIOGENIC CARBON BALANCE IN A GROUND WATER INFILTRATION ENRICHMENT SYSTEM, (IN RUSSIAN),
Academy of Municipal Economy, Moscow (USSR). Research Inst. of Public Water Supply, Water Purification.
For primary bibliographic entry see Field 5B.
W78-06030

PROCEEDINGS OF THE ELEVENTH BIENNIAL CONFERENCE ON GROUND WATER.
California Univ., Davis. Water Resources Center; and California State Dept. of Water Resources, Sacramento.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 669, Price codes: A09 in paper copy, A01 in microfiche. California Water Resources Center Report No. 41, November 1977, 189 p.

Descriptors: Groundwater, *Management, *Groundwater potential, Groundwater basins,

*Groundwater availability, *Groundwater recharge, Groundwater resources, Water rights, Conjunctive use, Legal aspects, Water policy, Storage, *California.

This conference held in Fresno on September 15-16, 1977, concentrated on ground water and ground water management in California. Many aspects of ground water management are examined including water rights, legal aspects, storage, public policy, recharge, and conjunctive use of ground water and surface water. (Snyder-Calif, Davis)
W78-06039

SEEPAGE FROM A TRAPEZOIDAL AND A RECTANGULAR CHANNEL USING VARIATIONAL INEQUALITIES,
California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.
J. C. Bruch, Jr., F. C. Sayle, and J. M. Sloss.
Journal of Hydrology, Vol. 36, No. 3/4, p 247-260, February 1978. 3 fig, 2 tab, 18 ref.

Descriptors: *Seepage, *Channels, *Soil water movement, *Model studies, Mathematical models, Permeability, Infiltration, Soil water, Open channels, Soils, Flow, Groundwater, Groundwater movement, Hydrology.

A variational inequality method was applied to the problem of two demensional seepage from trapezoidal channels and a rectangular channel into permeable soil underlain at a finite depth by a drain. Location of the free surface, shape of the seepage region, and seepage flow rate all appeared as solutions through the utilization of this method. The numerical portion of the problem was solved using successive overrelaxation methods with projection. Both finite-difference and finite-element methods were used. A discussion of the computer approach as given along with comparisons of the results. (Sims-ISWS)
W78-06098

IDENTIFICATION OF DISTRIBUTED PARAMETERS IN GROUNDWATER BASINS,
James Cook Univ. of North Queensland, Townsville (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W78-06100

CHEMICAL ASPECTS OF GROUND WATER RECHARGE WITH WASTEWATERS,
California Univ., Berkeley.
For primary bibliographic entry see Field 5B.
W78-06141

WATER RESOURCES DATA FOR OKLAHOMA, WATER YEAR 1975.
Geological Survey, Oklahoma City, OK. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-06175

WATER RESOURCES DATA FOR UTAH, WATER YEAR 1975.
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-06176

WATER RESOURCES DATA FOR MONTANA, WATER YEAR 1976.
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-06177

PUBLIC WATER SUPPLIES OF NORTH CAROLINA, PART 5. SOUTHERN COASTAL PLAIN,
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 4A.
W78-06178

GROUND-WATER RESOURCES OF EMMONS COUNTY, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
C. A. Armstrong.
North Dakota County Ground-Water Studies 23--Part III, and North Dakota Geological Survey Bulletin 66--Part III, (Bismarck), 1978. 43 p, 10 fig, 2 plates, 3 tab, 34 ref.

Descriptors: *Groundwater resources, *North Dakota, *Aquifer characteristics, *Water yield, Water quality, Water supply, Water users, Hydrogeology, Groundwater availability, Water wells, Water level fluctuations, Groundwater recharge, Transmissivity, Water analysis, Chemical analysis, Water types, Emmons County(N Dak).

Ground water in Emmons County, N. Dak., generally is obtained from glacial-drift aquifers of Quaternary age and the Fox Hills and Dakota aquifers of Cretaceous age. Glacial-drift aquifers with the greatest potential for development are the Strasburg, Long Lake, Braddock, and Winona. Properly constructed wells in the more permeable parts of these aquifers will yield from 500 to 1,000 gpm (gallons per minute). Water from these glacial-drift aquifers differs in chemical quality depending on sources of recharge. Dissolved-solids concentrations in samples from these aquifers ranged from 269 to 2,150 mg/liter. The Fox Hills aquifer underlies about 80 percent of the county and supplies water to about 75 percent of the wells. Yields from wells tapping the Fox Hills aquifer range from 0.5 to 40 gpm. The water generally is a sodium bicarbonate type that commonly contains less than 1,000 mg/liter dissolved solids in areas where sandstone crops out. It contains less than 1,500 mg/liter in areas where siltstone and silty shale crop out. The Dakota aquifer underlies Emmons County at depths that range from 2,200 to 2,530 feet. Unrestricted flows from wells in the aquifer range from 30 to 60 gpm. Water in the Dakota aquifer is a sodium sulfate type. Dissolved-solids concentrations ranged from 2,220 to 2,640 mg/liter and sulfate concentrations ranged from 1,140 to 1,440 mg/liter. (Woodard-USGS)
W78-06179

WATER RESOURCES INVENTORY OF NORTHWEST FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 6D.
W78-06183

USE OF THERMAL-INFRARED IMAGERY IN GROUND-WATER INVESTIGATIONS IN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.; and Kansas Univ., Lawrence. Space Technology Labs.
For primary bibliographic entry see Field 7B.
W78-06187

RECORD OF GROUND-WATER EXPLORATION AND DEVELOPMENT, 1975-76, MOEN, TRUK, EASTERN CAROLINE ISLANDS,
Geological Survey, Honolulu, HI. Water Resources Div.
D. A. Davis.
Open-file report 77-739, September 1977. 358 p, 1 fig, 2 ref.

Descriptors: *Groundwater resources, *Drilling, *Exploration, *Drillers logs, *Foreign projects, Water wells, Test wells, Pumping, Water yield, Water analysis, Chlorides, Water levels, Well data, Water supply, *Truk Islands, *Moen, Well construction.

The exploration for and development of ground water described in this report consisted of the drilling and testing of 22 holes and the conversion of 8 of the holes into production wells on the island of Moen, Truk Islands, in the period November 1975 to July 1976. The objective of the program was to find sources of water to provide an improved supply for the reservoirs and pipelines of the Moen water system. The bulk of the report consists of records collected at the drilling sites during drilling and testing. Given for each test hole are a description of the drilling operation; a record of development of the hole; a record of each pumping test; and a log of the hole giving a summary description of rock units penetrated by the bit. For wells, there are records, where they are available, of the reaming of test holes to production-well diameter; data on casing, screens, gravel pack, and grout seal; and records of pumping tests. (Woodard-USGS)
W78-06193

WATER RESOURCES OF NO NAME VALLEY, COLVILLE INDIAN RESERVATION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
D. R. Cline.
Open-file report 78-122, 1978. 105 p, 30 fig, 27 tab, 5 ref.

Descriptors: *Water resources, *Streamflow, *Groundwater resources, *Water storage, *Washington, Aquifer characteristics, Mapping, Water wells, Pumping, Water yield, Water level fluctuations, Hydrographs, Groundwater recharge, Water supply, Projections, Available water, Surface waters, Ponds, Streams, Flow rates, Hydrogeology, Hydrologic budget, *Colville Indian Reservation(Wash), *No Name Valley(Wash), *Omak Creek(Wash).

No Name Creek valley is a trough cut in granitic bedrock in north-central Washington. A low topographic divide in the northern third of the valley separates it into the No Name Creek basin on the south and Omak Creek basin on the north. Omak Creek is the larger stream and enters the valley through a narrow gorge in the eastern granite wall. Partly filled with unconsolidated sand, gravel, and silt to depths as great as 163 feet, the valley contains a ground-water reservoir which supplies four irrigation wells and several domestic-supply wells. The ground-water reservoir also feeds springs which give rise to No Name Creek, and it contributes some water to Omak Creek to the north. Under conditions of the pre-1976 development the ground-water divide was naturally about 3,000 feet north of Omak Creek gorge, and about 580 acre-feet of leakage from Omak Creek recharges the No Name Creek ground-water reservoir. By 1977, ground-water withdrawal of 994 acre-feet per year in No Name Creek basin had caused the ground-water divide to shift to a position about 4,000 feet north of the topographic divide. This increased the drainage area contributing to the No Name Creek ground-water reservoir for about three months so that during a year of normal flow a total of about 600 acre-feet of leakage from Omak Creek can be captured. It is postulated that as much as 1,100 acre-feet per year can be pumped in the central part of the reservoir. This pumpage would cause the ground-water divide to shift farther north, resulting in the capture of additional recharge from Omak Creek; the total leakage would be about 700 acre-feet per year. (Woodard-USGS)
W78-06194

LAND-SURFACE SUBSIDENCE IN THE HOUSTON-GALVESTON REGION, TEXAS,
Geological Survey, Houston, TX. Water Resources Div.
For primary bibliographic entry see Field 2F.
W78-06195

ESTIMATING PARAMETERS OF COMPACTING FINE-GRAINED INTERBEDS WITHIN A CONFINED AQUIFER SYSTEM BY A ONE-DIMENSIONAL SIMULATION OF FIELD OBSERVATIONS,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W78-06196

HYDROGEOLOGIC EFFECTS OF SUBSIDENCE, SAN JOAQUIN VALLEY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
B. E. Lofgren.
In: Proceedings of the Anaheim Symposium, December 1976: International Association of Hydrological Sciences Publication No 121, p 113-123, 1976. 7 fig, 4 ref.

Descriptors: *Land subsidence, *Compaction, *Pumping, *Aquifers, *California, Overdraft, Aquitards, Water management(Applied), Groundwater recharge, Water importing, Canals, Hydrology, Aquifer characteristics, Hydrologic data, Evaluation, *San Joaquin Valley(Calif).

Subsidence has slowed in most of the San Joaquin Valley, Calif., site of one of the most extensive manmade subsidence in the world. After 40 years of ground-water overdraft, canal imports have generally reversed declining water-level trends. As of 1976, artesian heads have recovered toward presubsidence levels, and subsidence rates have decreased from an earlier maximum 0.5 m/yr to near zero in much of the valley. Increasing irrigation demands, particularly during years of deficient precipitation, pose the threat of increased pumping and another cycle of widespread land subsidence. Because of significant hydrogeologic changes during the 1930-70 overdraft period, however, the ground-water basin will respond differently during a second cycle of overdraft. The close correlation between water-level decline, compaction of the aquifer systems, and land subsidence has been precisely monitored in the San Joaquin Valley for 2 decades. From these data, both the elastic and the 'virgin' inelastic stress-strain characteristics of the unconsolidated valley deposits and the response of the aquifer system to prolonged cyclic pumping overdraft have been determined. (Woodard-USGS)
W78-06197

LAND SUBSIDENCE STOPPED BY ARTESIAN-HEAD RECOVERY, SANTA CLARA VALLEY, CALIFORNIA,
Geological Survey, Sacramento, CA. Water Resources Div.
J. F. Poland.
In: Proceedings of the Anaheim Symposium, December 1976: International Association of Hydrologic Sciences Publication No 121, p 124-132, 1976. 7 fig, 6 ref.

Descriptors: *Land subsidence, *Compaction, *Pumping, *Aquifers, *California, Overdraft, Aquitards, Water management(Applied), Groundwater recharge, Water importing, Hydrogeology, Hydrologic data, Evaluation, *Santa Clara Valley(Calif).

From 1916 to 1966 in the San Jose area of Santa Clara Valley, California, generally deficient rainfall and runoff was accompanied by a fourfold increase in withdrawals of ground water. In response, the artesian head declined 180-250 ft. As a direct result of the artesian-head decline, the land surface subsided as much as 12.7 ft in San Jose, due to compaction of the fine-grained compressible aquitards as their pore pressures decreased. The subsidence caused flooding of lands bordering the southern part of San Francisco Bay; the compaction of the sediments caused compressional failure of well casings in several hundred wells. The gross costs of subsidence to date are estimated to be 15 to 20 million dollars. The recovery of artesian head since 1967 has been dramatic. In downtown San Jose, the artesian head in two index wells recovered about 100 ft in the 8 years from 1967 to 1975. Recovery of water levels was due to a fivefold increase in surface-water imports from 1965 to 1975, favorable local water supply, decreased withdrawal, and increased recharge. The subsidence has been stopped throughout the extent of the confined system as of 1974-75 by raising the artesian head in the aquifers until it equaled or exceeded the maximum pore pressures in the aquitards. However, Subsidence will resume if the artesian head is drawn down appreciably below the levels of 1971-73. (Woodard-USGS)
W78-06198

4C. Effects On Water Of Man's Non-Water Activities

EFFECTS OF DEICING SALTS ON WOODY VEGETATION ALONG MINNESOTA ROADS,
Minnesota Univ., St. Paul. Coll. of Forestry.
For primary bibliographic entry see Field 5B.
W78-05786

EFFECTS OF DEICING SALTS AND LEAD UPON TREES, SHRUBS AND SOILS IN CONNECTICUT,
Connecticut Dept. of Transportation, Wethersfield. Bureau of Planning and Research.
For primary bibliographic entry see Field 5B.
W78-05787

ECONOMIC AND ENVIRONMENTAL IMPACTS OF FOREST RESOURCE DEVELOPMENT,
Purdue Univ., Lafayette, IN.
For primary bibliographic entry see Field 6A.
W78-05803

REVIEW OF THE FLINT CREEK SMALL WATERSHED PROJECT, DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE ONTARIO COUNTY ENVIRONMENTAL MANAGEMENT COUNCIL,
Cornell Univ., Ithaca, NY. Center for Environmental Research.
For primary bibliographic entry see Field 6G.
W78-05814

JAMESPORT TRANSMISSION EXITS; A REVIEW FOR THE TOWN OF RIVERHEAD OF THE LONG ISLAND LIGHTING COMPANY APPLICATION TO THE NEW YORK PUBLIC SERVICE COMMISSION FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED FOR THE JAMESPORT TRANSMISSION EXITS,
Cornell Univ., Ithaca, NY. Center for Environmental Research.
For primary bibliographic entry see Field 6G.
W78-05816

METHODOLOGY FOR ANALYZING EFFECTS OF URBANIZATION ON WATER RESOURCE SYSTEMS,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5C.
W78-05938

ENGINEERING AND PEDOLOGICAL PROPERTIES OF SOILS AS THEY AFFECT SOIL ERODIBILITY,
California Univ., Davis. Dept. of Land, Air, and Water Resources; and California Univ., Davis. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2G.
W78-06036

FORESTS AND WATER: EFFECTS OF FOREST MANAGEMENT ON FLOODS, SEDIMENTATION, AND WATER SUPPLY,
Pacific Southwest Forest and Range Experiment Station, Berkeley, CA.
H. W. Anderson, M. D. Hoover, and K. G. Reinhart.
General Technical Report PSW-18, 1976. 115 p, 6 fig, 15 tab, 606 ref.

Descriptors: *Forests, *Forest management, Water resources, *Swamps, Wetlands, *Floods, *Water supply, Dikes, Bogs, Hydrologic aspects, Drainage effects, Lumbering, *Sedimentation, Bottomlands, Wet flats.

A summary is presented on the forest's influence on the water resource, particularly the effects of current forestry practices. Four types of wetland forests are discussed: (1) Wet Flats. Most efforts in water management are concentrated on wet flats supporting pines. One current practice is to remove surface water and lower ground water to increase trafficability of heavy equipment, (2) Bay, or Upland Bogs, typically produce little timber, water, forage, and wildlife. Not enough is known about the hydrochemical processes of the infertile soil to recommend measures to improve forest growth. Logging may increase water levels enough to endanger regeneration. (3) Swamps and Upland Ponds. Removal of surface water can kill older trees and destroy wildlife habitat. These values can be enhanced by installing dikes and water control structures. (4) Bottomlands are productive because of inherent fertility and abundant moisture. Uncontrolled drainage adversely affects stand compositon, tree growth, and regenerative potential. Current water management consists of a kind of flood irrigation. Hydrologic consequences of management of wetland forests have been little studied and are poorly understood. (Stihler-Mass)
W78-06089

THE EFFECT OF MILITARY TRANSPORTATION ACTIVITIES ON THE ENVIRONMENT,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Mobility and Environmental Systems Lab.
A. J. Green, D. D. Randolph, and A. A. Rula.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-032 971, Price codes: A04 in paper copy, A01 in microfiche. Miscellaneous Paper M-73-15, December 1973. 78 p, 3 fig, 36 tab, 14 ref. OCE 891-05-01-001.

Descriptors: *Transportation, *Military aspects, *Environment, Mathematical studies, Water quality, Vegetation, Air pollution, Water pollution, *Military transportation, Vehicles.

An evaluation is reported on the impact of military transportation activities upon related environmental attributes. The military activities were related to their impact on these attributes by means of a matrix. The matrix used a scale to identify the magnitude and probability of the impact. Additionally, known mitigation and abatement practices that can be used to minimize adverse environmental impacts were identified and briefly described. The principal conclusion was that this technique provides a first approximation for assessing the effect of military transportation on the environment. It was recommended that funding be provided to: (1) exploit existing data to generate quantitative relations to be used in developing en-

vironmental impact statements; and (2) finance research in those areas for which the need to quantify exists and the lack of data has been acknowledged. (Froelich-ISWS)
W78-06126

FINAL REPORT TO THE NATIONAL SCIENCE FOUNDATION RESEARCH APPLIED DIRECTORATE WEATHER MODIFICATION ASSOCIATION,
Wyoming Univ., Laramie. Dept. of Atmospheric Science.
For primary bibliographic entry see Field 3B.
W78-06130

HIGHWAY OPERATION AND PLANT DAMAGE-DATA APPENDIX (SOIL CHEMISTRY, SALT APPLICATION, OZONE, PRECIPITATION),
California State Dept. of Transportation, Sacramento. Transportation Lab.
D. I. Nakao, R. B. Howell, and E. C. Shirley.
Available from the National Technical Information Service, Springfield, VA 22161, Price codes: A09 in paper copy, A01 in microfiche. Report FHWA-CA-76-56, September 1976. 188 p, 3 fig, 3 ref. FHWA F-5-14 TL 657134.

Descriptors: *Highways, Effects, *Damages, *Salts, *California, Vegetation, Soil water, Soil chemistry, Sodium chloride, Ozone, Trees, Shrubs, Salt tolerance, Pollutants, Water pollution effects, Soil contamination effects, Vegetation effects, Data collections, Meteorological data, Temperature, Winds, Precipitation(Atmospheric), Water pollution, Salt application, Plant damage, Deicing salts, Salt concentrations.

The Transportation Laboratory is engaged in a study of the effects of deicing salts on roadside vegetation in and around the Lake Tahoe Basin. The portion of the study dealing with soil chemistry, salt application rates, ozone, and precipitation was reported in an Interim Report dated January 1976. This Appendix Report contains the backup data for that Interim Report. (Sims-ISWS)
W78-06131

4D. Watershed Protection

MEASUREMENT OF SEDIMENT CONTROL IMPACTS ON AGRICULTURE,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 5G.
W78-05701

THE APPLICATION OF REMOTE SENSING TO THE DEVELOPMENT AND FORMULATION OF HYDROLOGIC PLANNING MODELS.
Ecosystems International, Inc., Gambrille, MD.
Available from the National Technical Information Service, Springfield, VA 22161 as N76-18632, Price codes: A03 in paper copy, A01 in microfiche. Report ECO-76:C-2-2, January, 1976. 27 p, NASA-CR-144203.

Descriptors: *Remote sensing, *Watersheds(Basins), *Hydrology, *LANDSAT imagery, *Peak-rate model, Routing model, Simulation analysis, Planning, Systems analysis.

Three tasks were undertaken in this research effort: (1) the validation of the peak-rate model on an expanded set of watersheds; (2) the development of a routing model for complex basins; and (3) the quantitative hydrologic analysis of LANDSAT imagery. In the expanded validation of the peak-rate model, a thirty-one watershed example was selected with significant geographic and hydrologic diversity. The prediction supplied by the model was tested for each, with this output compared to the records and to forecasts computed by using three other conventional planning models. Discovered was that different geographic regions exhibit varying seasonal properties, but that within a region, the characteristics are similar. Next, a routing model was developed which approximated the watershed by a series of strips, each having its own set of surface and rainfall parameters. The output of these strips was summed using a simple time delay function accounting for the length of overland flow and the hydrologic characteristics of the channel. It was found that both the sensitivity of runoff to the basin slope and the areal extent of rainfall were significant and should be provided for by the planning model. The final task used remote sensing directly to determine the hydrologic information content of the LANDSAT bands and to attempt to extract the necessary hydrologic data. It was discovered that information sufficient to determine several of the important inputs to the model could be determined from LANDSAT data using relatively uncomplicated visual techniques. (See also W77-10296) (Bell-Cornell)
W78-05718

PROPAGATION AND USE OF SPARTINA ALTERNIFLORA FOR SHORELINE EROSION ABATEMENT,
North Carolina State Univ. at Raleigh.
For primary bibliographic entry see Field 4A.
W78-05751

EFFECT OF SOIL HEAT FLUX ON THE WATER BALANCE OF A SMALL CATCHMENT,
Waikato Univ., Hamilton (New Zealand). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2G.
W78-05777

FALLOUT CESIUM-137 IN CULTIVATED AND NONCULTIVATED NORTH CENTRAL UNITED STATES WATERSHEDS,
Agricultural Research Service, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 5B.
W78-05779

AQUEOUS- AND SEDIMENT-PHASE PHOSPHORUS YIELDS FROM FIVE SOUTHERN PINE WATERSHEDS,
Southern Forest Experiment Station, Oxford, MS.
For primary bibliographic entry see Field 5B.
W78-05781

ECONOMIC AND ENVIRONMENTAL IMPACTS OF FOREST RESOURCE DEVELOPMENT,
Purdue Univ., Lafayette, IN.
For primary bibliographic entry see Field 6A.
W78-05803

DEVELOPMENT OF A VERSION OF STANFORD MODEL AND ITS EVALUATION FOR STREAMFLOW SYNTHESIS FROM SMALL WATERSHEDS IN WEST VIRGINIA,
West Virginia Univ., Morgantown. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2E.
W78-05808

REVIEW OF THE FLINT CREEK SMALL WATERSHED PROJECT, DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE ONTARIO COUNTY ENVIRONMENTAL MANAGEMENT COUNCIL,
Cornell Univ., Ithaca, NY. Center for Environmental Research.
For primary bibliographic entry see Field 6G.
W78-05814

SEDIMENTATION AND SOIL ALTERATION, MONROE RESERVOIR, INDIANA,
Indiana Univ., Bloomington. Dept. of Geology.
For primary bibliographic entry see Field 2J.
W78-05815

METHODOLOGY FOR ANALYZING EFFECTS OF URBANIZATION ON WATER RESOURCE SYSTEMS,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5C.
W78-05938

EFFECTS OF SILT AND TURBIDITY FROM AGRICULTURAL DRAINAGE ON BENTHIC INVERTEBRATES IN STREAMS IN WESTERN MINNESOTA,
Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries and Wildlife.
T. F. Waters.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 764, Price codes: A02 in paper copy, A01 in microfiche. Minnesota Water Resources Research Center, Minneapolis, March 1978. 12 p, 5 fig, 1 tab. OWRT B-120-MINN(1), 14-31-0001-6091.

Descriptors: *Silts, *Turbidity, *Minnesota, Streams, *Watershed management, Distribution, Clays, *Benthos, Stream ecology, *Agricultural drainage, Drift, *Aquatic invertebrates.

Four streams located in southwestern Minnesota were selected to study the effect of intensive agricultural drainage in their watersheds upon the abundance and ecology of benthic stream invertebrates. Abundance, species composition, and drift of stream invertebrates were determined at sites on the streams downstream from the drained region of the watershed. The headwaters and small tributaries in the watersheds of two streams had been intensively ditched, while the other two streams, with most of the headwater tributaries in a natural condition, served as controls. Preliminary results indicated no substantial differences between the two sets of streams in total abundance, distribution, or drift, although important differences on the species level are likely. Experiments were run in laboratory streams and in situ at the field sites, where silt and clay were applied experimentally to invertebrate populations; little adverse effects on the invertebrates were observed. (Waelti-Minnesota)
W78-06065

BACTERIAL VARIATIONS IN STREAMS FROM A SOUTHWEST IDAHO RANGELAND WATERSHED,
Agricultural Research Service, Boise, ID. Northwest Watershed Research Center.
For primary bibliographic entry see Field 5B.
W78-06116

EROSION AND SEDIMENT CONTROL. SURFACE MINING IN THE EASTERN U.S. VOLUME I. PLANNING. VOLUME II. DESIGN,
Hittman Associates, Inc., Columbia, MD.
For primary bibliographic entry see Field 5G.
W78-06127

WATER-QUALITY ASSESSMENT OF THE MIDDLE FORK ANDERSON RIVER WATERSHED, CRAWFORD AND PERRY COUNTIES, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
For primary bibliographic entry see Field 5A.
W78-06190

A WATER-QUALITY ASSESSMENT OF THE BUSSERON CREEK WATERSHED, SULLIVAN,

VIGO, GREENE, AND CLAY COUNTIES, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
For primary bibliographic entry see Field 5B.
W78-06191

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

REMOTE SENSING OF LAND USE AND WATER QUALITY RELATIONSHIPS-WISCONSIN SHORE, LAKE MICHIGAN,
Cold Regions Research and Engineering Lab., Hanover, NH.
R. K. Haugen, H. L. McKim, and T. L. Marlar.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A030 746, Price codes: A04 in paper copy, A01 in microfiche. Report 76-30, August 1976. 47 p, 22 fig, 11 tab, 23 ref. NASA SR/T 160-75-89-05-10.

Descriptors: *Remote sensing, *Lake Michigan, *Wisconsin, *Land use, *Water quality, Suspended load, Manitowoc River(WI), East Twin River(WI), Oconto River(WI), Water pollution, Monitoring, Mapping, Thermal imagery, Infrared imagery, Microwave imagery, Multispectral scanners, Aerial photography, Lakes, Shores, Watersheds(Basins), Rivers.

Various types of aerial imagery were evaluated for their usefulness in assessing effects of land use on sediment loading of streams on the Wisconsin shore of Lake Michigan. High altitude color infrared imagery acquired at 60,000 ft with a 9-in format RC-8 and Zeiss cameras was the most acceptable remote sensing technique for the mapping and measurement of land use types. Other sensors evaluated included: (1) High altitude RS-7 thermal scanner--useful for mappng major circulation patterns in large water bodies. (2) RS-14 thermal scanner--recommended for maping effluent plumes and differentiating within wetlands or impervious urban settings, although lack of geometric control, narrow field of view, and cost largely preclude its use. (3) High altitude multispectral 70mm photography (Hasselblad)-- the small format was difficult to work with, and data was more easily obtained with the 9-in format cameras. (4) High-altitude color (SO 397)--although applicable to small area, single flight line surveys, this method does not appear feasible for regional area surveys or with high altitude imagery due to wide variation in color balance and other factors. (5) PMIS (Passive Microwave Imaging System)--severe limitations were encountered, and it was not possible to consistently identify major patterns on a 64 color photographic rendition of PMIS scanning data. Sample mapping was done for the Manitowoc, East Twin, and Oconto watersheds. (Lynch-Wisconsin)
W78-05749

IMPACT OF LAND USE ON GROUND WATER QUALITY IN THE GRAND TRAVERSE BAY REGION OF MICHIGAN,
Duke Univ., Durham, NC. School of Forestry and Environmental Studies.
R. Rajagopal.
Journal of Environmental Quality, Vol 7, No 1, p 93-98, January-March 1978. 6 fig, 5 tab, 17 ref. NOAA 04-3-158-23.

Descriptors: *Groundwater, *Water quality, *Land use, *Michigan, Surveys, Sampling, Pollutants, Water pollution, Path of pollutants, Water pollution sources, Septic tanks, Chemical analysis, Chemicals, Nitrates, Nitrites, Ammonia, Chlorides, Orchards, Fertilizers, Statistical analysis, Correlation analysis, *Grand Traverse Bay Region(Mich).

Investigations in townships surrounding the Grand Traverse Bay of Michigan showed an identifiable geographic relationship between groundwater quality and land use. Wells averaging 32 m deep in thinly populated areas measured an average of 3.75 ppm nitrate-N, indicating the effect of prolonged years of fertilizer application. Wells averaging 19 m deep in predominantly residential areas had an average of 1.31 ppm nitrate-N, indicating possible contamination from septic tank effluents. An average of 0.18 ppm of ammonia-N was detected in marshy wetlands. An analysis of temporal variations in groundwater quality with reference to precipitation, streamflow, and a trend component provided high as well as low R sq (0.92 to0.12; R sq = square of the multiple correlation coefficient) producing regression models, indicating the effect of site specific conditions. A year-long observation of a sample well (43 m deep) surrounded by cherry orchards had an average of 18.25 ppm nitrate-N in a range of 13.09 to 20.64 ppm, almost double the standard considered safe for human consumption. Ammonia-N and chloride measurements from a shallow well (12.5 m deep), surrounded by residential and commercial activities, showed synchronized variations over a year (correlation coefficient r = 0.75, significant at 1% level), suggesting the existence of a common source of contamination. In summary, it was reiterated that the analysis of groundwater quality problems requires a different philosophical approach fom the approaches used for water quantity and surface water quality modeling. (Sims-ISWS)
W78-05778

EFFLUENTS FROM CATFISH PONDS DURING FISH HARVEST,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
C. E. Boyd.
Journal of Environmental Quality, Vol 7, No 1, p 59-62, January-March 1978. 2 fig, 2 tab, 13 ref.

Descriptors: *Fish farming, *Alabama, *Catfishes, *Fish harvest, *Pollutants, Effluents, Ponds, Water quality, Fish, Channel catfish, Aquiculture, Water pollution, Water pollution sources, Organic matter, Biochemical oxygen demand, Chemical oxygen demand, Phosphates, Ammonia, Nitrates, Measurement, *Auburn(Ala).

Samples of effluents from eight channel catfish ponds at Auburn, Alabama, collected during fish harvest, were analyzed for BOD, COD, settleable matter, soluble orthophosphate, total phosphorus, total ammonia, and nitrate. Settleable matter concentrations, for which 3.3 ml/liter has been suggested as the instantaneous maximum for effluents from fish ponds, ranged from 0 to 1.2 ml/liter during the fraining phase when 95% of water was discharged. Water discharged during seining to remove fish usually contained greater than 3.3 ml/liter settleable matter (range 0.5 to 100 ml/liter). Concentrations of other potential pollutants, except nitrate, also increased during the seining phase. However, even effluents discharged during the draining phase had higher levels of most measured parameters than first-order streams draining forested or agricultural watersheds in the vicinity. (Sims-ISWS)
W78-05783

REMOTE DETERMINATION OF THE CONCENTRATION OF SUSPENDED PARTICLES IN THE WATER OF RESERVOIRS ON THE BASIS OF MEASUREMENTS OF SPECTRAL LUMINANCE COEFFICIENTS,
For primary bibliographic entry see Field 2H.
W78-05790

CHEMICAL SYSTEMS MONROE RESERVOIR, INDIANA,
Indiana Univ., Bloomington. Dept. of Geology.
For primary bibliographic entry see Field 2H.
W78-05805

OZONE OXIDATION OF ORGANIC SEQUESTERING AGENTS IN WATER PRIOR TO THE DETERMINATION OF TRACE METALS BY ANODIC STRIPPING VOLTAMMETRY,
California Univ., Berkeley. Lawrence Berkeley Lab.
R. G. Clem, and A. T. Hodgson.
Analytical Chemistry, Vol 50, No 1, p 102-110, January, 1978. 6 fig, 3 tab, 27 ref.

Descriptors: *Analytical techniques, *Water analysis, *Electrochemistry, *Ozone, *Oxidation, Chemical degradation, Heavy metals, *Pollutant identification, Effluents, Sewage, Chemical analysis.

Acids, normally used to destroy naturally occurring sequestering agents in water samples prior to trace metal analysis by anodic stripping voltammetry (ASV), can rapidly destroy the graphite electrodes used in the analysis. Ozone oxidation was evaluated as an alternative to acidification in the analysis of bay water and sewage effluents for Pb and Cd. Ozone is a strong oxidizing agent which has been observed to inactivate sequestering agents over a pH range of 2-10. Ethylenediaminetetraacetic acid (EDTA), ammonium pyrrolidine dithiocarbamate (APDC), tannic acid, and humic acid solutions were used to simulate the complexing agents present in sewage and natural waters. A corona discharge tube and a high-voltage transformer were used to generate ozone from oxygen which was introduced at a flow rate of 3 liters/min. Solutions containing 3 ppm EDTA, 25 ppm APDC, 25 ppm humic acid, 100 ppm tannic acid, and 20 ppb Cd and Pb were ozonized under acidic and basic conditions; and the relative metal recoveries were compared. Approximately 96% of the Cd and 99% of the Pb were recovered from a 100 ppm humic acid solution after 3 hours of ozonolysis. The adsorption of surface active compounds onto the graphite electrode produced a loss of sensitivity which increased in proportion to the length of contact time between the electrode and the sample solution. Ozonolysis was recommended for application to on-line ASV systems for measuring heavy metal concentrations in waste water effluents. (Schulz-FIRL)
W78-05871

THE APPLICABILITY OF TRACER TECHNIQUES FOR STUDIES ON SEWAGE TREATMENT PROCESS DYNAMICS,
Technical Research Center of Finland, Esbo.
For primary bibliographic entry see Field 5D.
W78-05872

A MICRO-KJELDAHL TECHNIQUE FOR NITROGEN DETERMINATION IN WATER, WASTEWATER, AND SLUDGE,
Butler, Fairman and Seufert, Inc., Carmel, IN.
R. L. Stephenson.
Journal Water Pollution Control Federation, Vol 49, No 12, p 2499-2502, December, 1977. 2 tab, 5 ref, 1 append.

Descriptors: *Nitrogen, *Ammonia, *Amino acids, *Acids, *Ammonium compounds, Testing procedures, Analytical techniques, Measurements, Nitrogen compounds, Nitrification, Application methods, Methods, Waste water treatment.

A modification of the micro-Kjeldahl technique was developed as a simplified method of measuring the nitrogen content in waste water, sludge, and water. A 5-ml sample containing ammonia nitrogen is subjected to a temperature of 340C, producing ammonium bisulfate and ammonium sulfate. The sample is diluted after digestion with ammonia-free water and its pH is raised to 10 with the addition of sodium hydroxide. The nesslerization technique is used to calculate the ammonia nitrogen concentration in the sample. The simplified technique was tested in laboratory experiments with four representative amino acids:

glycine, methionine, tryptophan, and diphenylcarbazone. The nitrogen concentrations of the samples were 500, 250, 50, and 10 mg/liter. Nitrogen recovery from glycine, used to represent a monoamino monocarboxy acid, ranged 92-100%. Nitrogen recovery with methionine, used as a long-change, sulfur-containing amino acid, ranged 96-124%. Tryptophan, as a heterocyclic acid, exhibited recoveries of 100-160%. Diphenylcarbazone, insoluble in acid solutions, showed poor recovery of nitrogen, ranging 8.4-120%. (Lisk-FIRL)
W78-05878

CONSERVATION OF SAMPLES OF WASTE WATER BY COOLING (KONSERVIERUNG VON ABWASSERPROBEN DURCH KUEHLUNG),
H. Gudernatsch.
Wasser, Luft, und Betrieb, Vol. 21, No. 11, p 598-600, 1977. 4 fig, 2 tab, 7 ref.

Descriptors: *Pollutant identification, Analytical techniques, *Chemical oxygen demand, *Water analysis, *Temperature, *Sampling, Industrial wastes, Municipal wastes, Carbon, Testing procedures, Variability, Waste water treatment.

The influence of sample treatment and storage temperature on the total organic carbon (TOC) and COD values of industrial and combined municipal-industrial waste waters was evaluated. Samples were collected at waste water treatment plants after the primary treatment stage and from the treated stream. Differences of not more than 10% in TOC and COD values measured in samples which had been subjected to various types of handling and storage were considered insignificant. The COD and TOC values obtained for most of the homogenized samples were significantly higher than those of filtered samples. The differences between sedimented and filtered samples were significant in 2 out of 8 cases only. Experiments on the effect of storage length and temperature revealed that storage at 20 C for more than 24 hours would result in erroneous TOC and COD data. Storage for up to 7 days at 4 C and for up to 28 days at -18 C did not affect TOC and COD determinations. (Takacs-FIRL)
W78-05882

DETERMINATION OF CHLORINE DIOXIDE IN SEWAGE EFFLUENTS,
Wastewater Technology Center, Burlington (Ontario).
J. R. Knechtel, E. G. Janzen, and E. R. Davis.
Analytical Chemistry, Vol. 50, No. 2, p 202-205, February, 1978. 5 fig, 3 tab, 14 ref.

Descriptors: *Pollutant identification, *Chlorination, *Analytical techniques, *Dyes, *Tracers, *Spectrophotometry, Colorimetry, Resonance, Chlorine, Nitrites, Waste water treatment, Municipal wastes.

An spectrophotometric technique with acid chrome violet K decolorization was developed for the measurement of chlorine dioxide in waste water. Maximum absorbance of acid chrome violet K in a dilute solution with chlorine dioxide occurred at 550 nm. The chlorine dioxide content was measured after solids removal with a spectrophotometer at pH 8.1-8.4. A similar procedure was devised for the reaction of acid chrome violet K with chlorine, hypochlorite, chlorite, chloramine T, and nitrite to determine interference. Effluent samples were also analyzed for chlorine dioxide content with an electron spin resonance technique for verification of the acid chrome violet K data. Simultaneous analysis for chlorine dioxide with the colorimetric and the electron spin techniques was necessary because of the decay rate of chlorine dioxide. Both techniques gave similar chlorine dioxide values in sample tests. (Lisk-FIRL)
W78-05884

TRACE METAL DISTRIBUTIONS AMONG THE HUMIC ACID, THE FULVIC ACID, AND PRECIPITABLE FRACTIONS EXTRACTED WITH NAOH FROM SEWAGE SLUDGES,
California Univ., Riverside. Dept. of Soil and Environmental Science.
K. H. Holtzclaw, D. A. Keech, A. L. Page, G. Sposito, and T. J. Gange.
Journal of Environmental Quality, Vol. 7, No. 1, p 124-127, January-March, 1978. 2 fig, 4 tab, 11 ref.

Descriptors: *Pollutant identification, *Path of pollutants, *Trace elements, *Humic acids, *Fulvic acids, *Chemical precipitation, *Sewage sludge, *Spectrophotometry, Aluminum, Cadmium, Copper, Iron, Nickel, Zinc, Carbon, Phosphorus, Waste water treatment, Municipal wastes.

Trace metal concentrations in the humic acid, fulvic acid, and precipitable fractions of four organic sludge-soil samples were measured in laboratory experiments with atomic absorption spectrophotometry. After extraction with sodium hydroxide, the humic acid, fulvic acid, and precipitable fractions were analyzed for concentrations of aluminum, cadmium, copper, iron, nickel, zinc, phosphorus, and carbon. Precipitation of the trace metals from solution with pH adjustments to 4.5, 6.5, and 8.5 was examined. Precipitation by pH adjustment of the trace metals, phosphorus, and carbon from the solutions suggested that most of the copper and carbon in the sludge samples was contained in the humic acid fraction. The precipitable fraction, a high ash precipitate formed after pH adjustment of impure fulvic acid, contained the highest concentrations of aluminum, iron, znc, and phosphorus. Cadmium and nickel were associated primarily with the fulvic acid extration and to a lesser extent, the precipitable fraction. (Lisk-FIRL)
W78-05888

SALMONELLA AND BACTERIAL INDICATORS IN OZONATED AND CHLORINE DIOXIDE-DISINFECTED EFFLUENT,
Ontario Ministry of Health, Toronto.
D. A. Schiemann, M. H. Brodsky, and B. W. Ciebin.
Journal Water Pollution Control Federation, Vol 50, No 1, p 158-162, January, 1978. 5 tab, 17 ref.

Descriptors: *Disinfection, *Chlorination, *Ozone, *Bioassay, *Salmonella, *Coliforms, *Bioindicators, Sewage bacteria, Microorganisms, Sewage treatment, Waste water treatment, Analytical techniques.

Studies were conducted to examine the incidence of Salmonella in secondary waste water effluent and to assess various methods for recovery. The relationship of Salmonella isolation to densities of three bacterial indicator groups (total coliforms, fecal coliforms, and fecal streptococci) in effluents disinfected by ozone and chlorine dioxide was also examined. Samples of effluent from a secondary activated sludge waste water treatment plant in Brampton, Ontario, were disinfected under controlled laboratory conditions. Salmonella recovery by a membrane filter and a glass fiber filter were compared; membrane filter and a glass fiber filter were compared; membrane filter and MPN counts were also compared for total and fecal coliforms in effluent disinfected by chlorine and ozone. Recovery rates for Salmonella from undisinfected primary and secondary effluents were 88.9 and 72.5%, respectively. Rates for effluents which has been treated with ozone, chlorine dioxide, and chlorine were 8.9, 12.5, and 0.0%, respectively. For undisinfected secondary effluent, incubation of the tetrathionate broth at 4.5C with OLD agar and brilliant green sulfa agar was most effective. Higher coliform densities were generally found in ozonated and chlorinated effluents in which Salmonella had been detected. (Schulz-FIRL)
W78-05890

HALOGENATED HYDROCARBONS IN WASTEWATERS: KNOWNS AND UNKNOWNS,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5B.
W78-05914

PRECISION OF CHLORINATED HYDROCARBON MEASUREMENTS,
Southern California Coastal Water Research Project, El Segundo.
T. C. Heesen, and D. R. Young.
In: Southern California Coastal Water Research Project Annual Report for the Year Ended 30 June 1977, p 69-74, 1977. 5 tab.

Descriptors: *Baseline studies, *Environmental effects, Resources development, *Water pollution sources, *Pollutant identification, *Toxicity, DDT, Polychlorinated biphenyls, Sediments, Waste water, Runoff, Water pollution, *Outer Continental Shelf, Southern California Bight, Chlorinated hydrocarbons, Chlorinated benzene.

In the trace organics program for the past year, the degree of variability of measurements of chlorinated hydrocarbons in sediments, fish tissues, wastewaters, storm runoff, and aerial fallout have been investigated. The parameter selected for this purpose is the coefficient of variation (CV: expressed as a precentage), which is defined as 100 times the standard deviation of a set of values divided by its mean. The studies have shown that, when aliquots of a homogenized sample are considered, the majority of the CV's fall within the 10- to 20-percent range. Present techniques for analyzing DDT, dieldrin, PCB, and chlorinated benzene residues in samples of sediments, organisms, municipal wastewater, surface runoff, and dry aerial fallout appear to yield results that usually have a coefficient of variation of about 20% or less. (See also W78-05911) (Sinha-OEIS)
W78-05918

SATELLITE IMAGERY STUDIES,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5B.
W78-05919

A MODIFIED PERCHLORINATION PROCEDURE FOR THE DETERMINATION OF POLYCHLORINATED BIPHENYLS,
Wisconsin Univ.-Madison. Water Chemistry Lab.
L. P. Burkhard, and D. E. Armstrong.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 610, Price codes: A02 in paper copy, A01 in microfiche. Wisconsin Water Resources Center, Madison, Technical Report WIS WRC 78-01, 1978. 23 p, 3 tab, 8 fig, 4 ref, 2 append. OWRT A-067-WIS(1). 14-34-0001-6052, 14-34-0001-7105, 14-34-0001-7106.

Descriptors: *Organic compounds, *Waste water treatment, *Water supply, *Aroclors, *Pesticide residues, *Pollutant identification, *Polychlorinated biphenyls, Perchlorination procedure, Water treatment, Chlorination.

Accurate quantitative measurement of polychlorinated biphenyls in environmental samples poses a difficult analytical problem. This difficulty arises in part from the complexity of the commercial PCB mixture (Aroclors) which are the main source of PCBs in the environment. In theory, chlorination of biphenyl can produce 210 different compounds. Consequently, the Aroclors, produced by chlorination of biphenyl to a certain weight percentage of chlorine, contain more than 50 individual PCB compounds. The purpose of this investigation was to develop a perchlorination technique which would provide quantitative measurements of total PCB and biphenyl concentrations in extracts from environmental samples. The

technique should give quantitative recovery of PCBs containing low (e.g., Aroclor 1221) or high (e.g., Aroclor 1254) numbers of chlorine atoms substituted on the biphenyl molecule. Furthermore, since biphenyl may be present in environmental samples and is converted to decachlorobiphenyl by the perchlorination reaction, a method giving quantitative recovery of biphenyl is also needed. Perchlorination of Aroclor 1254, Aroclor 1221, and biphenyl standards using the stepwise increase in reaction temperature resulted in complete recovery of Aroclors 1254 and 1221. However, recovery of biphenyl was low. In summary, an improved perchlorination procedure has been developed which gives quantitative recovery of PCBs in various Aroclor standards, but biphenyl is somewhat low. (Diamantis-Wisconsin)
W78-05939

APPROACHES TO THE STUDY OF MICROBIAL TRANSFORMATIONS OF METALS,
National Bureau of Standards, Washington, DC.
For primary bibliographic entry see Field 5B.
W78-05978

UTILIZATION OF SATELLITE DATA FOR INVENTORYING PRAIRIE PONDS AND LAKES,
Environmental Research Inst. of Michigan, Ann Arbor.
For primary bibliographic entry see Field 2H.
W78-05979

LEAD CONTAMINATION IN DRINKING WATER IN LJUBLIJANA, (IN SLOVENIAN),
V. Sirnik, A. Petelinsek, and I. Burgermeister.
Zb Biotch Fak Univ Ljublj Kmetijstvo 25, p 199-202, 1975.

Descriptors: *Yugoslavia(Ljublijana), *Lead, *Potable water, Sampling, *Pollutant identification, Public health, *Photometry.

Samples of pipeline water in Ljubljana (Yugoslavia) were analyzed with the photometric ditizon-method in 3 town areas about 1 km from each other. Levels of 4.0, 9.6 and 16.0 ppb Pb were found. The Pb concentration did not reach the limit of injuriousness to health, 50 ppb. The reason for the highly significant differences between the town areas was not investigated.--Copyright 1978, Biological Abstracts, Inc.
W78-05981

A METHOD OF MEASURING AIRBORNE ACIDITY: ITS APPLICATION FOR THE DETERMINING OF ACID CONTENT ON LONG-DISTANCE TRANSPORTED PARTICLES AND IN DRAINAGE WATER FROM SPRUCES,
Swedish Water and Air Pollution Research Lab., Goteborg.
C. Brosset.
Water, Air, and Soil Pollution, Vol. 6, No. 2-4, p 259-275, 1976. 7 fig, 9 tab, 14 ref.

Descriptors: *Airborne acidity, *Acidity, *Gran's plot, Methodology, *Volumetric analysis, *Sweden, Spruces, Trees, Coniferous trees, Particles, Drainage water, Equations, Sulfur compounds, Gothenburg(Sweden), Airborne transport, Deposition, Acids, Path of pollutants, *Air pollution, Measurement, Seasonal.

A method for measuring airborne acidity to lakes and land, using a titration procedure based on Gran's plot, is described and is demonstrated for transported acidic particles in southern Sweden and for drainage water from spruces in two forest areas near Gothenburg, Sweden. The method enables determination of stronger acids (p sub a < about 3). Since autumn 1972 a study of airborne particles at Rao, a remote coastal station 40 km south of Gothenburg, shows that during winter and under special meteorological conditions high concentrations of black particles can build up due to long-distance transport. During summer acid concentration is higher in the particles. Small white particles are transported to the Swedish west coast chiefly from the southwest, but acidification of land and lakes is probably limited as white episodes are infrequent. The water-soluble part of particles (phi < about 1 micrometer) mainly consist of relatively acid ammonium sulfates. The phases (NH4)2SO4, (NH4)3H(SO4)2, and NH4HSO4 have been identified. Acid particles are successively neutralized during transport over land by NH3 uptake. Experiments with drainage water from spruces indicate that dry deposition of particles on the trees with subsequent secondary washout can result in large acid depositions on the ground. (Lynch-Wisconsin)
W78-06003

ANALYSIS OF THE FLUORINE ION IN THE PRESENCE OF AL AND CA IONS IN AIR AND WATER WITH THE USE OF ZR-SPADNS REAGENT, (IN RUSSIAN),
G. S. Salyamon, and S. R. Ivanova.
Gig Sanit 1, p 64-65, 1977.

Descriptors: *Fluorine ions, Aluminum, Calcium, Ions, *Pollutant identification, *Photometry, Air analysis, Water analysis, Water analysis, Analytical techniques.

Photocolorimetric analysis was possible without preliminary distillations or other methods of separation with the use of a Zr-SPADNS (4-sulfophenylazo-1,8-dihydroxynaphthalene-3,6-disulfonic acid) reagent. High reagent specificity permitted F- analysis in the presence of 500 micro g Ca with direct photocolorimetric methods. Analysis in the presence of Al required heating the sample containing Zr-SPADNS to facititate the breaking of the Al-F complex. It was possible to analyze from .1-6 microg F in a sample with 100 microg of Al present. Details of analysis in air and water from sewage and melted snow were presented.--Copyright 1978, Biological Abstracts, Inc.
W78-06008

THE PROBLEM OF DETERMINATION OF CYANIDES IN WATER IN THE PRESENCE OF NITRILES, (IN RUSSIAN),
V. A. Panova, M. N. Brycheva, and Yu. Yu. Lure.
Gig Sanit 3, p 63-64, 1977.

Descriptors: *Cyanides, *Pollutant identification, *Nitriles, Industrial wastes, Chemical precipitation, Separation techniques, Water analysis, Acetone cyanchydrin, Acrylonitrile cyanchydrin.

The vase development of artificial fiber production and increased effluents in sewage from acrylonitrile and acetone cyanohydrin additives made it essential to test the effect of nitriles (organic cyanides) on determination of cyanides in water. Determination of cyanides in sewage must be preceded by their separation from nitriles. The most effective method was precipitation of cyanides with silver nitrate with subsequent careful washing of the precipitate with water and acetone, decomposition of the precipitate in a highly acidic medium and distillation of the hydrocyanic acid into a alkali. Relative error ranged from 2-7%, due to the large number of operations in the method.--Copyright 1978, Biological Abstracts, Inc.
W78-06013

LONG RANGE TRANSPORT OF AIR POLLUTANTS IN EUROPE AND ACID PRECIPITATION IN NORWAY,
Norwegian Meteorological Inst., Oslo; and Norsk Inst. for Luftforskning, Kjeller.
J. Nordo.
Water, Air and Soil Pollution, Vol. 6, No. 2-4, p 199-217, September-November 1976. 19 fig, 7 ref.

Descriptors: *Norway, *Europe, *Air pollution, *Airborne transport, *Path of pollutants, *Acid precipitation, *Dispersion models, Acidity, Scandinavia, Model studies, Trajectory models, Deposition, Precipitation(Atmospheric), Sulfur compounds, Winds, Aerosols.

Daily observations of river and lake acidification in Scandinavia have been made and acid precipitation episodes have been studied since the late 1960s, using back trajectories to trace the origin of air pollutants. In 1971 a large-scale dispersion model was developed to estimate long-range transport of air pollutants, and during 1972-73 several model studies were conducted. Emission data for 1972 shows highest concentrations of SO2 in parts of East Germany (1.3-1.7 million metric tons/yr), West Germany (1.8 million), and England (1.0-1.1 million). These sources may result in highly acid precipitation 500-1000 miles away. Acid precipitation episodes are usually most clearcut in southern Norway due to enhanced (orographical) precipitation for winds between SW and SE. When Atlantic lows move into the Norwegian Sea, converging air streams may transport pollutants from western and central Europe towards the Norwegian mountains. When polluted air masses approach the mountain slopes, cooling may result in intense scavenging of pollutants. Case studies of such events are described. The large-scale dispersion models take into account chemical transformation as well as deposition of pollutants. Results from the use of a simple and economical trajectory model are presented, using data for December 1973-March 1974 in Norway. (Lynch-Wisconsin)
W78-06018

A PROPOSED MODIFICATION TO THE CLASSICAL METHOD OF CALCULATING ALKALINITY OF NATURAL WATERS,
Auburn Univ., AL.
S. R. Jenkins, and R. C. Moore.
Journal of American Water Works Association, Vol. 69, No. 1, p 56-59, January 1977. 2 fig, 3 tab, 8 ref.

Descriptors: *Pollutant identification, *Alkalinity, *Methodology, *Analytical techniques, *Measurement, Manuals, *Standard methods, Bicarbonate alkalinity, Carbonate alkalinity, Hydroxide alkalinity, Waste water treatment, Phenolphthalein alkalinity.

The classical method for calculating alkalinity of natural waters as described in the 13th edition of 'Standard Methods for the Examination of Water and Wastewater' is inaccurate in certain cases due to the false assumption that hydroxide and bicarbonate alkalinity do not exist simultaneously. As it is an accepted fact that these species may in fact exist together, a modification of the classical method is proposed to correct the error which occurs whenever bicarbonate and hydroxide concentrations are approximately equal. In situations where one ion is negligible, calculations can be performed as described in 'Standard Methods.' Since error only occurs when bicarbonate and hydroxide concentrations are about equal, the modification proposes to assume them equal under such circumstances; the hydroxide alkalinity is determined directly from pH measurements, bicarbonate alkalinity is set equal to hydroxide alkalinity, and carbonate alkalinity is then the total alkalinity minus twice the hydroxide alkalinity. In the range of 0.4T < or =P < or =0.6T, the modified calculation method was 76% more accurate than the classical method for data sets taken from past literature. It is suggested that Table 102 in 'Standard Methods' be replaced by Table 3 of this paper, and the discussion following Table 102 amended. (Lynch-Wisconsin)
W78-06019

NUTRIENT CONTENT AND PRECIPITATION OVER IOWA,
Iowa State Univ., Ames. Dept. of Agronomy.
M. A. Tabatabai, and J. M. Laflen.

Water, Air, and Soil Pollution, Vol. 6, No. 2-4, p 361-373, September-November 1976. 5 fig, 4 tab, 29 ref.

Descriptors: *Precipitation(Atmospheric), *Chemical precipitation, *Iowa, *Cycling nutrients, Nutrients, Seasonal, Acidity, Nitrogen compounds, Sulfur compounds, Phosphorus compounds, Water pollution sources.

Six sites selected for the study of amounts of nitrogen, sulfur, and phosphorus in precipitation over Iowa were located on a line from northeast to southwest of the state. Precipitation samples collected for 27 months during 1971-1973 were analyzed for pH, NH4-N, NO3-N, PO4-P, SO4-S, and NO2-N. Average annual concentrations in precipitation ranged from 0.38 plus or minus 0.48 to 0.86 plus or minus 0.53 ppm for NH4-N, and from 0.36 plus or minus 0.24 to 0.99 plus or minus 0.98 ppm for NO3-N. Amounts of inorganic nitrogen added per hectare per year ranged from 10 kg in north-central to 14 kg in west-central Iowa. Amounts of SO4-S added ranged from 13 kg in the northeastern to 17 kg in north-central Iowa. Precipitation adds an estimated 0.6 kg of NH4-N, 0.6 kg NO3-N, and 1.5 kg of SO4-S per hectare monthly. PO4-P concentrations in precipitation were low. Only about 0.1 kg of PO4-P per hectare were added annually. NO2-N was not detected in any of the precipitation samples. Average pH values ranged from 5.8 plus or minus 0.8 to 6.5 plus or minus 0.3. Seasonal variation in concentration values was observed only for SO4-S. It was high during fall and winter and low during spring and summer. (Harris-Wisconsin)
W78-06020

HYDROGEN ION SPECIATION IN THE ACID PRECIPITATION OF THE NORTHEASTERN UNITED STATES,
Cornell Univ., Ithaca, NY. Section of Ecology and Systematics.
J. N. Galloway, G. E. Likens, and E. S. Edgerton.
Water, Air, and Soil Pollution, Vol. 6, No. 2-4, p 423-433, September-November 1976. 1 fig, 4 tab, 18 ref.

Descriptors: *Precipitation(Atmospheric), *Northeast U.S., *Chemistry of precipitation, *Water pollution sources, *Hydrogen ion concentration, Acidity, Free acidity, Total acidity, Eutrophication, Ithaca(NY), Hubbard Brook Experimental Farm(NH), Paul Smith(NY), White Mountains(NH).

In any water sample there are two types of acidity that can be measured: free and total. Free acidity is a measure of the concentration of protons in solution, regardless of source. Total acidity indicates protons in solution and those still undissociated. Free acidity and total acidity were determined for precipitation samples from Ithaca, New York (a semi-urban community), Hubbard Brook Experimental Forest, New Hampshire (a forested area in the White Mountains), and Paul Smith, New York (a forested area in the Adirondack Mountains). The samples were collected in February-May 1975. According to results of the chemical analysis, the primary sources of H ions that cause the phenomenon of acid precipitation are strong mineral acids, H2SO4 and HNO3. All other components (H2CO3, NH4, Al, Fe, and Mn), with the exception of an organic acid (RCOOH) contribute only to the total acidity. Although precipitation collected from rural, forested regions (Hubbard Brook and Adirondack Mountains) has less weak acids than that collected in the semi-urban area (Ithaca), the levels of free acidity in both areas is within the range of pH 3.8 to 4.4. This indicates that the regional phenomenon of acid precipitation is influenced by local urban effects. (Harris-Wisconsin)
W78-06025

HYDROGEN INPUT TO THE HUBBARD BROOK EXPERIMENTAL FOREST, NEW HAMPSHIRE, DURING LAST DECADE,
Cornell Univ., Ithaca, NY. Section of Ecology and Systematics.
G. E. Likens, F. H. Bormann, J. S. Eaton, R. S. Pierce, and N. M. Johnson.
Water, Air, and Soil Pollution, Vol 6, No 2-4, p 435-445, September-November 1976. 9 fig, 2 tab, 13 ref.

Descriptors: *Precipitation(Atmospheric), *Hubbard Brook Experimental Farm(NH), *Chemistry of precipitation, *Water pollution sources, *Hydrogen ion concentration, Sampling, Eutrophication, Anions, Sulfates, Cations, Acidity.

Precipitation chemistry has been monitored at the Hubbard Brook Experimental Forest New Hampshire since 1963. The site is downwind of eastern and midwestern industrial centers and as such offers a strategic location to monitor changes in regional precipitation chemistry. Precipitation samples have been collected on a storm or weekly basis. Sulfate and H ions dominate the precipitation. Sulfate is 2.5 times more important than the next most abundant anion NO-3, and H+ is 5.9 times more important than the next most abundant cation NH+4. Rain and snow at Hubbard Brook are highly acidic. The average annual weighted pH during the period 1964-1974 ranged between 4.03 and 4.21. The lowest pH value reported for a storm at Hubbard Brook was 3.0. There was a downward trent in annual pH values between 1964-65 to 23 micro eq per liter in 1973-74. H ion concentrations in precipitation have increased 1.4 times between 1964 and 1974. Based on a stoichiometric formation process in which the sea-salt anionic component is subtacted from the total anions in precipitation, SO-4 contribution to acidity dropped from 83% to 66%, and NO-3 increased from 15% to 30%. H ion concentrations showed significant correlation with increased input of nitrate to precipitation. (Harris-Wisconsin)
W78-06026

THE CHEMICAL COMPOSITION OF ATMOSPHERIC PRECIPITATION FROM SELECTED STATIONS IN MICHIGAN,
Michigan Univ., Ann Arbor. School of Natural Resources.
C. J. Richardson, and G. E. Merva.
Water, Air, and Soil Pollution, Vol 6, No 2-4, p 385-393, September-November 1976. 4 fig, 1 tab, 34 ref. NSF-RANN GI-348 98.

Descriptors: *Precipitation(Atmospheric), *Michigan, *Chemistry of precipitation, *Water pollution sources, Acidity, Rainfall, Hydrogen ion concentration, Cations, Nitrates, Sulfates, Chlorine, Phosphates, Calcium, Magnesium, Sodium, Sampling, Eutrophication.

Examination of pH values for rainfall from 60 stations in Michigan reveals that extremes are found throughout the state. The median acidity for the entire state is 6.3. The weighted annual pH is 5.03. On a regional basis northern lower Michigan, an area of low population density and industry, has the highest annual median pH (6.55). The heavily populated and industrialized southern portions of the state closely follow the entire state's frequency distribution and median pH value. The Upper Peninsula shows low pH values for localities near pulp and mining industries in the Western half of the peninsula. Analyses by individual stations reveal the importance of point source inputs and ground loading effects. Thus, Dimondale, located near a concrete tile plant, has a median pH value of 8.45, while Vassar located between Detroit and Toledo has pH median value of 4.80. A comparison of annual nutrient loading for NO3-, SO4--, Ca++, Mg++, K+. pH of rainwater between the Michigan and Eastern U.S. stations reveals that eastern U.S. stations reporting pH of less than 4.02 have similar loadings for NO3 but twice the SO4 input found for rural Michigan areas. (Harris-Wisconsin)
W78-06027

SEPARATE DETERMINATION OF ACRYLIC AND METHACRYLIC ACIDS IN WATER USING PAPER CHROMATOGRAPHY, (IN RUSSIAN),
Nauchno-Issledovatelskii Inst. Gigieny, Moscow (USSR).
R. S. Ekhina.
Gig Sanit 2, p 78-80, 1977.

Descriptors: *Pollutant identification, Methodology, Acrylic acids, *Chromatography, Acids, Waste water treatment.

A method for the separate determination of acrylic and methacrylic acids, toxic substances found in the waste waters of the acrylate industry, was observed. It is based on the transformation of the acids into complex esters and then into nonvolatile hydroxamic derivatives, giving a color reaction with trivalent Fe salts. Sensitivity of the method is 0.3 mg/l, and the relative error is 15%. It has been applied in the hygienic evaluation of the biological purification of waste waters from a chemical plant.--Copyright 1978, Biological Abstracts, Inc.
W78-06029

THE ABC'S OF DIATOM IDENTIFICATION USING LASER HOLOGRAPHY,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
J. Cairns, Jr., K. L. Dickson, and J. Slocomb.
Hydrobiologia, Vol. 54, No. 1, p 7-16, 1977. 8 fig, 1 tab, 26 ref. NSF/RANN/IT/GI-38357/PR/7312.

Descriptors: *Diatoms, *Laser holography, Pollutant identification, *Monitoring, Algae, Water quality control, Instrumentation, River basins, Lasers, Data collections, Ecosystems.

A biomonitoring system that employs coherent optical spatial filtering techniques (laser holography) to rapidly identify diatoms and to process species abundance information, is described. Currently in the development stage, the system can in the future be used in river basin monitoring. The system: (1) provides identification using type specimens furnished by a diatom taxonomist; and (2) is an operational experimental unit capable of identifying all individuals structurally similar to the type specimen. The system is not designed to describe new species or provide insights into diatom structure. Electro-optical and computer hardware/software are being developed for automation of the prototype. Diatom taxonomy is based primarily on recognition of physical patterns on the cleared cell frustule, and diatoms, being rigid and having complex character sets, are very suitable for pattern recognition using the technique described in this study. In this system, the filter, basically a holographic record of the two-dimensional periodic or aperiodic structure of the diatom type specimen, is used to sift complex wavelengths from the unknown diatoms. A match between filter and unidentified specimens produces a bright spot of light at a point beyond the filter. In the present optical system 35-mm black and white transparencies of diatoms were used as input specimens; as yet coupling a microscope to the system has not been accomplished. (Lynch-Wisconsin)
W78-06035

ALGAL ASSAY PROCEDURE BOTTLE TEST.
Pacific Northwest Water Lab., Corvallis, OR.
For primary bibliographic entry see Field 5C.
W78-06043

THE QUALITY OF LAKE OF THE OZARKS.
Environmental Protection Agency, Region VII, Kansas, MO.
For primary bibliographic entry see Field 5B.

W78-06050

MERCURY CONCENTRATIONS IN FISH IN LAKE OAHE, SOUTH DAKOTA, APRIL 16 TO SEPTEMBER 27, 1972.
Environmental Protection Agency, Denver, CO.
For primary bibliographic entry see Field 5C.
W78-06051

THE FLUOROMETRIC BEHAVIOR OF PULPING WASTE LIQUORS, A VALUABLE TOOL FOR LIGNIN AND PULPING RESEARCH,
Oregon State Univ., Corvallis. School of Forestry.
W. J. Bublitz, and T. Y. Meng.
Tappi, Vol 61, No 2, p 27-30, February, 1978. 6 fig, 3 tab, 5 ref.

Descriptors: *Pollutant identification, Pulp and paper industry, *Fluorometry, *Analytical techniques, *Hemlock trees, *Douglas fir trees, Lodgepole pine trees, Lignins, *Pulp wastes, Waste water treatment, Industrial wastes.

Fluorometric behavior was measured for the pulping waste liquors of Douglas fir, western hemlock, and lodgepole pine. The tests with pulping liquors indicated that fluorescence was a linear function of the lignin content of the waste liquors and correlated to other pulping parameters, such as yield and Kappa number. Douglas fir pulping liquor exhibited peak fluorescence at a wavelength of 430 nm but at a lower intensity than for Douglas fir of the same lignin concentration. Lignin in lodgepole pine liquors fluoresced at 485 nm with an excitation of 370 nm. Dilution of the pulping liquor by 1,000-10,000 times was necessary for accurate measurements of the lignin concentration. A reduction of solution pH from 12 to 6-7 produced a shift in the peak of fluorescent and excitation wavelengths for the pulping liquors of the three wood types were relatively equal, although the intensity of the wavelengths was found to vary. (Lisk-FIRL)
W78-06077

ELECTRON-BEAM OXIDATION TREATMENT OF A COMMERCIAL DYE BY USE OF A DUAL-TUBE BUBBLING COLUMN REACTOR,
Japan Atomic Energy Research Inst., Tasasaki. Tasasaki Radiation Chemistry Research Establishment.
For primary bibliographic entry see Field 5D.
W78-06079

POLLUTION INDICATORS AND OTHER MICROORGANISMS IN RIVER SEDIMENT,
Connecticut Univ., Storrs. Biological Sciences Group.
E. A. Matson, S. G. Hormor, and J. D. Buck.
Journal Water Pollution Control Federation, January 1978, p 13-19, 4 fig, 6 tab, 21 ref. OWRT A-052-CONN(17).

Descriptors: *Pollutant identification, Water pollution sources, Water quality, *Sediments, Rivers, Indicators, *Bioindicators, *Bacteria, *Yeasts, Microorganisms.

Data collected during a 3-year study of indicator and other bacteria and yeasts in the Shetucket River basin in northeastern Connecticut is presented. Analysis of the data shows high indicator densities in sediments and a high and variable sediment/water ratio for several groups of organisms; the potential for health hazard information in the sediment in the absence of such information from water analysis; and a synthesis of several concepts which stress the need for a more accurate sampling strategy than that currently employed. (Chilton-ORNL)
W78-06096

SEASONAL TRENDS OF NH4(+) AND NO3(-) NITROGEN ISOTOPE COMPOSITION IN RAIN COLLECTED AT JULICH, GERMANY,
Kerntorschungsanlage Juelich G.m.b.H. (West Germany). Inst. fuer Chemie.
H. D. Freyer.
Tellus, Vol 30, No 1, p 83-92, February 1978. 5 fig, 8 tab, 42 ref.

Descriptors: *Isotope studies, *Nitrogen, *Chemistry of precipitation, *Precipitation(Atmospheric), Sampling, Rainfall, Rain water, Data collections, Seasonal, Chemical analysis, Ammonia, Ammonium compounds, Nitrates, Nitrogen compounds, Fertilizers, Foreign countries, Farm wastes, Foreign research, Livestock, Urine, Pollutants, Water pollution, Water pollution sources, Meteorology, *West Germany, Julich(Germany).

Data were presented on nitrogen isotope composition in ammonium and nitrate from rain water collected over 2 years in an interior area at Julich, Germany. The seasonal trends in the data were discussed relative to natural and anthropogenic emissions of nitrogen compounds which additionally have been measured or estimated in their isotope composition, e.g., ammonia from animal urine, fuel combustion, fertilizer use and organic soil nitrogen, and natural and anthropogenic nitric oxides from automobile exhausts as well. The 15N content of Julich rain ammonium was found to be different from values of Hoering and Moore and from other rain samples collected in coastal areas. (Sims-ISWS)
W78-06113

COMPARATIVE CHEMISTRY OF A COOLING RESERVOIR AND ITS WATER SOURCE,
North Texas State Univ., Denton. Dept. of Biological Science.
For primary bibliographic entry see Field 5B.
W78-06114

EVALUATION OF LEACHATE CHARACTERISTICS AND PHYSICAL PROPERTIES OF COMPACTED MIXTURES OF FLY ASH AND WASTEWATER SLUDGE,
West Virginia Univ., Morgantown.
For primary bibliographic entry see Field 5B.
W78-06118

HERBICIDE REPORT: CHEMISTRY AND ANALYSIS, ENVIRONMENTAL EFFECTS, AGRICULTURAL AND OTHER APPLIED USES.
Environmental Protection Agency, Washington, D.C. Hazardous Materials Advisory Committee.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 006, Price codes: A10 in paper copy, A01 in microfiche. Report No EPA-SAB-74-001, May 1974. 196 p, 5 fig, 33 tab, 388 ref, append. 1HA410.

Descriptors: *Herbicides, *Environmental effects, *Chemical analysis, *Pesticide residues, *Aquatic weed control, Pesticides, Agriculture, Eutrophication, Gas chromatography, Classification, Bioaccumulation, Degradation(Decomposition), Cost-benefit analysis, Water pollution effects, Soil contamination, Air pollution, Water pollution sources, Rates of application.

Fifteen selected herbicides are evaluated for chemical structure, environmental effects, and application: Alachlor, Propachlor, Linuron, Diuron, Atrazine, Propazine, Tribluralin, Nitralin, 2,4-D, Chloramben, Butylate, Acrolein, copper sulfate, Endothall, and Xylene. Thirteen major groups based on chemical structure are recognized; synthesis, analysis, and properties of each are discussed. Environmental considerations include sources and movements of herbicides; residues in soil, water, and air; bioaccumulation of residues; effects on nontarget plants; and the costs and benefits of herbicide use. Herbicide uses are described, and alternative methods are evaluated. Herbicides make up about 50% of quantities of all pesticides used in the United States, and about 134 are currently registered. Of 500 million pounds of herbicides used annually in the U.S., 85.2% are applied to crops, 14.6% to rights-of-way and similar areas, and 0.2% in aquatic environments. Beneficial effects of herbicide use include increased crop yield and release of land from cropping, enhancement of recreation areas, and habitat improvement. Major herbicide pollution sources are drift during application, and volatilization and runoff after application. Residues do not appear to build up in air, water, or soil, and nearly all are at least partially metabolized by plants, animals, or soil-microbial systems. (Lynch-Wisconsin)
W78-06133

COOLING DISCONTINUOUS WATERS WITH A SINGLE REFRIGERATION UNIT,
Arizona Univ., Tucson. School of Renewable Natural Resources; and Arizona Cooperative Fishery Research Unit.
For primary bibliographic entry see Field 5G.
W78-06146

RELATION OF SAMPLE VARIATIONS TOPLATE ORIENTATION IN THE HESTER-DENDY PLATE SAMPLER,
North Dakota State Dept. of Health, Bismarck. Div. of Water Supply and Pollution Control.
For primary bibliographic entry see Field 7B.
W78-06147

ORGANOCHLORINE RESIDUES IN NEW JERSEY OSPREY EGGS,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
S. N. Wiemeyer, D. M. Swinford, P. R. Spitzer, and P. D. McLain.
Bulletin of Environmental Contamination and Toxicology, Vol. 19, No. 1, 1978, p 56-63. 3 tab, 23 ref.

Descriptors: *Polychlorinated biphenyls, *DDE, *Chlorinated hydrocarbon pesticides, Path of pollutants, Water pollution effects, *DDT, *DDE, *Dieldrin, Heptachlor, *Pesticide residues, *Ospreys, *Osprey eggs, Barnegat Bay, Mirex, Chlordane, Shell thickness.

Data are presented on the levels of organochlorine pesticides and polychlorinated biphenyls in the eggs of New Jersey ospreys, the changes in eggshell thickness. These data are related to similiar data for declining and stable osprey populations in other areas. DDE and PCB's were found in all eggs. The high residual levels of DDE and PCB's in the New Jersey osprey eggs appear to have been an important factor in the reduced rate of reproductive success. (Katz-EIS)
W78-06150

THE ACUTE AND CHRONIC EFFECTS OF CADMIUM ON THE ESTUARINE MYSID MYSIDOPSIS BAHIA,
Environmental Research Lab., Gulf Breeze, FL.
For primary bibliographic entry see Field 5C.
W78-06152

THE FATE OF FENITROTHION IN AN AQUATIC ECOSYSTEM,
Ottawa Univ. (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W78-06161

ORGANOCHLORINE RESIDUES IN POTENTIAL FOOD ITEMS OF MARINE BALD EAGLES (HALIAEETUS LEUCOCEPHALUS), 1966 AND 1974,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.

S. N. Wiemeyer, A. A. Belisle, and F. J. Gramlich.
Bulletin of Environmental Contamination and Toxicology, Vol. 19, No. 1, p 64-72, 1978. 2 tab, 21 ref.

Descriptors: *Food chain, *Food habits, Foods, Maine, *Chlorinated hydrocarbon pesticides, DDE, DDD, *DDT, *Polychlorinated biphenyls, Yellow perch, Herring, Suckers, Atlantic salmon, Bullheads, Eels, Freshwater fish, Gulls, *Bald eagles, Alewife, Pickerel.

Potential bald eagles food items were collected from several areas in Maine in both 1966 and 1974 in a preliminary effort to determine the source of organochlorine pollutants found in the eagles and their eggs, to determine whether organochlorine levels were different in areas with dissimilar rates of eagle reproductive success, and to determine whether gross changes in residue levels had occurred through time. (Katz-EIS)
W78-06164

PHYSIOLOGICAL INDICES OF STRESS IN MYTILUS EDULIS,
Institute for Marine Environmental Research, Plymouth (England).
For primary bibliographic entry see Field 5C.
W78-06168

HEAVY METALS IN THE BURROWING BIVALVE SCROBICULARIA PLANA FROM THE TAMAR ESTUARY IN RELATION TO ENVIRONMENTAL LEVELS,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
For primary bibliographic entry see Field 5C.
W78-06169

FEEDING RATE OF MYTILUS EDULIS L. (BIVALVIA) FROM DIFFERENT PARTS OF DANISH WATERS IN WATER OF DIFFERENT TURBIDITY,
Copenhagen Univ. (Denmark). Zoological Lab.
For primary bibliographic entry see Field 2L.
W78-06170

DETERMINATION OF BIOCHEMICAL-OXYGEN-DEMAND PARAMETERS,
Geological Survey, Bay St. Louis, MS. Water Resources Div.; and Geological Survey, Lakewood, CO. Water Resources Div.
M. E. Jennings, and D. P. Bauer.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 739, Price codes: A04 in paper copy, A01 in microfiche. Gulf Coast Hydroscience Center Computer Contribution, June 1976. 41 p, 4 fig, 11 ref.

Descriptors: *Biochemical oxygen demand, *Dissolved oxygen, *Mathematical models, *Aquatic microorganisms, *Organic wastes, Water quality, Waste dilution, Streamflow, Water pollution, Water pollution control, Aquatic environment, Pollutants, Water chemistry, Analytical techniques.

The computer program described in this manual determines biochemical-oxygen-demand (BOD) from the results of laboratory tests and determines two parameters of the first-order kinetic model for BOD. The parameters are k, the process rate constant, days; and Lo, the ultimate dissolved-oxygen demand, mg/liter. By use of the computer program, the parameters may be determined by three different methods: (1) The Thomas method, (2) the least-squares method, or (3) the nonlinear least-squares method. The rate constant parameter is determined in base-10 and base-e forms. Options for sample rea. ration, sample dilution, immediate BOD, and initial lag are contained in the program. (Woodard-USGS)
W78-06174

WATER RESOURCES DATA FOR OKLAHOMA, WATER YEAR 1975.
Geological Survey, Oklahoma City, OK. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-06175

WATER RESOURCES DATA FOR UTAH, WATER YEAR 1975.
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-06176

WATER RESOURCES DATA FOR MONTANA, WATER YEAR 1976.
Geological Survey, Helena, MT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-06177

GROUND-WATER RESOURCES OF EMMONS COUNTY, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 4B.
W78-06179

SELECTED HYDROLOGIC DATA, PAROWAN VALLEY AND CEDAR CITY VALLEY DRAINAGE BASINS, IRON COUNTY, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-06180

WATER-QUALITY ASSESSMENT OF THE MIDDLE FORK ANDERSON RIVER WATERSHED, CRAWFORD AND PERRY COUNTIES, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
M. A. Ayers.
Open-file report 78-71, January 1978. 31 p, 11 fig, 5 tab, 20 ref.

Descriptors: *Water quality, *Surface waters, *Watersheds(Basins), *Indiana, *Water analysis, Sampling, Chemical analysis, Dissolved solids, Nutrients, Bacteria, Dissolved oxygen, Phytoplankton, Pesticides, Suspended solids, Sediments, Evaluation, *Middle Fork Anderson River(Ind), Crawford County, Perry County.

This report, on water quality for streams in Crawford and Perry Counties, Indiana, defines the variation in concentrations of nutrients, inorganic constituents, suspended sediment, bacteria, and phytoplankton in streams, and chlorinated hydrocarbons in bed materials in the Middle Fork Anderson River watershed; identifies areas and sources of water-quality problems; and determines the effects of existing flood-retarding structures on water quality. The data base for this water-quality assessment included five sets of samples collected from September 1975 through July 1976. Temperature, specific conductance, pH, and dissolved-oxygen concentration of water were measured, and stream discharge was estimated at 25 sites. Samples for laboratory analysis were collected at 9 of these sites in September 1975, at 8 of the sites in December 1975, and at 7 of the sites in March, June, and July 1976. Surface-water quality in the watershed is generally good except for problem-causing concentrations of bacteria, dissolved oxygen, and phosphorus at some sites along the main stem during low flow, and manganese at most sites year-round. (Woodard-USGS)
W78-06190

A WATER-QUALITY ASSESSMENT OF THE BUSSERON CREEK WATERSHED, SULLIVAN, VIGO, GREENE, AND CLAY COUNTIES, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
For primary bibliographic entry see Field 5B.
W78-06191

QUALITY OF RIVERS OF THE UNITED STATES, 1974 WATER YEAR--BASED ON THE NATIONAL STREAM QUALITY ACCOUNTING NETWORK (NASQAN),
Geological Survey, Reston, VA. Water Resources Div.
R. O. Hawkinson, J. F. Ficke, and L. G. Saindon.
Available from OFSS Br. of Dist. USGS Box 25425, Fed. Ctr. Denver, CO 80225 paper copy $7.00, microfiche $4.00. Open-file report 77-151, February 1977. 158 p, 16 fig, 9 tab, 21 ref.

Descriptors: *Water quality, *Rivers, *United States, *Streams, *Water temperature, Sediment transport, Inorganic compounds, Nutrients, Bacteria, Phytoplankton, Dissolved solids, Evaluation, *NASQAN system.

The National Stream Quality Accounting Network (NASQAN) was established by the U.S Geological Survey to determine and compare the quality at key locations on the Nation's major rivers. There are 345 stations in the network--data from the first 101 of these (those operating during the 1974 water year) are summarized in this report. Temperature data from NASQAN stations have been summarized for each station. At most stations the harmonic provides an estimate of daily temperatures with a standard error of estimate of 2.5 degrees C or less. According to 1974 water-year data summarized from NASQAN operations, water quality of the rivers of the United States is best (by most standards) in the Northeast, Southeast, and Northwest. Waters there generally are low in dissolved solids and major and minor chemical constitutents, generally are soft (except in Florida), and carry relatively small amounts of sediment. However, many of these waters carry moderate or high levels of major nutrients and have correspondingly high populations of attached and floating plants. High counts of indicator bacteria also show signs of local pollution at some sites. Rivers of most of the Midcontinent and Southwest are characterized by moderate to high levels of dissolved major and minor constituents, sediment, major nutrients, and biota (floating and attached aquatic plants and indicator bacteria. (Woodard-USGS)
W78-06192

PALEOGEOCHEMISTRY AND INTERSTITIAL WATER CHEMISTRY FROM SEDIMENTS OF FIVE MAINE LAKES,
Maine Univ. at Orono. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2H.
W78-06199

5B. Sources Of Pollution

A WATER QUALITY PLANNING MODEL WITH MULTIPLE TIME, POLLUTANT, AND SOURCE CAPABILITIES,
Meta Systems Inc., Cambridge, MA.
R. DeLucia, E. McBean, and J. Harrington.
Water Resources Research Vol 14, No 1, p 9-14, February 1978. 4 fig, 12 ref.

Descriptors: *Water pollution control, *Planning, *Capacity expansion, *Waste treatment, Pollutants, Constraints, Economies of scale, Optimization, Legislation, Biomass, Linearization, Mathematical models, Systems analysis, Equations.

The imposition of recent U.S. legislative requirements (Public Law(PL) 92-500) with the 1977 and 1983-1985 water quality goals requires that water

quality management plans must weigh both degree of treatment and capacity expansion questions. A planning model capable of reflecting the implications of the pollutant constraints and the scale economies of point source abatement implicit in the legislation is developed. The model captures within a mathematical programming format important characteristics of decisions associated with the time-related water pollution control goals of PL 92-500. The model's unique features are the utilization of a biomass potential parameter as a measure of water quality and a set of heuristic procedures involving linearization of the waste treatment capacity-removal curves. These features allow avoidance of nonconvexity problems associated with analogous models. The model also includes the usual BOD, DO, N, and P water quality measures; it was applied in a recent planning study for the Saint John Basin in Maine. (Bell-Cornell)
W78-05702

PROGRAMMER'S AND USER'S MANUAL FOR THE TRIBUTARY WATER QUALITY MODEL (FINAL REPORT ON PHASE 2),
Center for the Environment and Man, Inc., Hartford, CT.
J. T. Ball, L. E. Johnson, and G. M. Northrop.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 095, Price codes: A04 in paper copy, A01 in microfiche.
Study of the Impact of Economic Development and Land Utilization Policies on the Quality of the Environment, Initial Application to England. Report No NSF-RA-E-75-158, NSF, Washington, D.C., October 1975. 66 p, 15 fig, 3 tab, append.

Descriptors: *Water quality, *Mathematical models, *Land use, Planning, Regional analysis, Industries, Economic development, Pollution, *Computer programs, Manuals, Environmental impacts, Equations, Dissolved oxygen, Biochemical oxygen demand, Temperature, Flow rate, Fecal coliforms, Dissolved solids, Systems analysis.

This study examines alternative land use plans and environmental control policies that affect regional economic development, population growth, and environmental quality. As part of its water quality analyses phase, a one-dimensional tributary water quality model is developed. The objective of the model is to develop data on tributary water quality parameters as they enter the main stem of a larger stream. The requirements for this study call for a model capable of outputting six characteristics at selected points along a stream: flow rate; temperature; dissolved oxygen deficit; biochemical oxygen demand remaining to be exerted; total dissolved solids; and total fecal coliforms. The model must be able to accommodate secondary inputs of flow, both from natural streams (subtributaries) and industrial/municipal outfalls. The model must also be able to accommodate withdrawals of flow and point changes in characteristics. The model is applied to eleven tributaries--seven in Connecticut and four in Massachusetts. This version of the Programmer's and User's Manual shows examples of test data results for the Hockanum River. The model includes an optional on-line graphical printout to all parameters. This feature is useful in presenting results to decision makers. (Bell-Cornell)
W78-05717

A WATER QUALITY OPTIMIZATION MODEL FOR NONSERIAL RIVER SYSTEMS,
Calgary Univ. (Alberta).
M. B. Bayer.
In: Mathematical Models for Environmental Problems. Proceedings of the International Conference held at the University of Southampton, England, September 8-12, 1975. C.A. Brebbia (Ed.), Southampton University. John Wiley & Sons, N.Y., N.Y., p 253-267. 1976. 3 tab, 12 ref.

Descriptors: *Water quality control, *Optimization, *River systems, *Standards, *Evaluation, *Water policy, Dissolved oxygen, Biochemical oxygen demand, Water temperature, Reach(Streams), Thermal pollution, Constraints, River basins, Construction costs, Equations, Mathematical models, Systems analysis, Simulation analysis, *Nonlinear programming, Biodegradable wastes, Transfer functions.

Described is a modeling method for evaluating policies for achieving specified water quality standards in a nonserial river system. The river system is assumed to be a closed economic system to avoid the problem of accounting for the external diseconomies of internal pollution abatement decisions. The system is assumed to be under the management of a single agency which has the legal authority to specify and codify river water quality standards. These standards are designated as lower limits on DO concentration, upper limits on BOD concentration, and upper limits on water temperature in the various reaches of the river system. It is the agency's purpose to control the amount of biodegradable materials and waste heat introduced into the receiving waters to meet the standards. Only biodegradable and thermal wastes are considered herein. The water quality model is formulated as a set of interdependent mathematical programming problems with nonlinear objective functions and linear constraints. The model is developed assuming that the following are known for each tributary branch and the mainstream: (1) minimum allowable DO and maximum allowable BOD concentrations; (2) maximum allowable water temperature; (3) equilibrium air temperatures in the basin; (4) rate constants for the physical phenomena in the river system; (5) minimum mean period mainstream and tributary flows; and (6) construction costs for pollution abatement structures throughout the operating ranges for these structures. (See also W78-05720) (Bell-Cornell)
W78-05725

THE PRIMARY PRODUCTION OF PHYTOPLANKTON IN EXPERIMENTS ON BIOMONITORING AT THE UCHINSKOYE RESERVOIR, (IN RUSSIAN),
Moscow State Univ. (USSR). Dept. of Hydrobiology.
For primary bibliographic entry see Field 5C.
W78-05733

COMPUTER MODELLING OF GROUNDWATER 13C AND 14C ISOTOPE COMPOSITIONS,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2F.
W78-05767

DRIFT RESPONSE OF MONOMOLECULAR SLICKS TO WAVE AND WIND ACTION,
Hamburg Univ. (West Germany).
For primary bibliographic entry see Field 2L.
W78-05773

DILUTION GAUGING ON THE RECESSION LIMB: 1. CONSTANT RATE INJECTION METHOD,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 8B.
W78-05774

THE SPEED AND DIRECTION OF MOVEMENT OF STORM RAINFALL PATTERNS WITH REFERENCE TO URBAN STORM SEWER DESIGN,
British Meteorological Office, Bracknell (England).
R. J. Shearman.
Hydrological Sciences Bulletin, Vol 22, No 3, p 421-431, September 1977. 7 fig, 9 ref.

Descriptors: *Rainfall, *Storms, Movement, *Distribution patterns, Networks, Gages, Precipitation gages, Rain gages, Precipitation(Atmospheric), Winds, Velocity, Frequency analysis, Urban runoff, Urban hydrology, Storm drains, Design, *England.

A pilot investigation of the direction and speed of movement of storm rainfall patterns in an area near London was described briefly. Within the limited scope of the pilot study, which used only 15 of the 53 raingages in the Surrey and Greater London Council network, the results suggested that there is no preferred direction of storm movement. There is a preferred range of medium level (700 mb) wind directions from 200 deg to 290 deg, but there is no evidence that the majority of storms move with the direction and speed of the medium level wind. Aproximately 60% of the storms analyzed in the study moved with speeds greater than about 15 m/s. Thus, many storms move with greater speeds than those of general interest to the urban drainage engineer. The results did not suggest that storm paths departed from the 700 mb wind field in any organized manner. For example, there was no obvious dependence on storm intensity. However, a large number of storms were not tracked successfully and were eliminated due to the reduced raingage network and the problem of multi-cellular storms. Thus, the results are based on approximately 230 storms, a relatively small sample compared with the 670 storms originally select. d. Suggestions were made for future work in the form of a more comprehensive investigation. (Sims-ISWS)
W78-05776

IMPACT OF LAND USE ON GROUND WATER QUALITY IN THE GRAND TRAVERSE BAY REGION OF MICHIGAN,
Duke Univ., Durham, NC. School of Forestry and Environmental Studies.
For primary bibliographic entry see Field 5A.
W78-05778

FALLOUT CESIUM-137 IN CULTIVATED AND NONCULTIVATED NORTH CENTRAL UNITED STATES WATERSHEDS,
Agricultural Research Service, Oxford, MS. Sedimentation Lab.
J. C. Ritchie, and J. R. McHenry.
Journal of Environmental Quality, Vol 7, No 1, p 40-44, January-March 1978. 1 fig, 3 tab, 27 ref. ERDA AT(49-7) 3029.

Descriptors: *Cesium, *Sediments, *Soils, *Watersheds(Basins), Data collections, Regression analysis, Erosion, Soil erosion, Reservoirs, Rainfall, Precipitation(Atmospheric), Soils, Farm management, Cultivated lands, Pollutants, Path of pollutants, Nonpoint pollution.

The cesium (137Cs) concentrations were measured in the soils and sediments of 14 watersheds, 7 cultivated and 7 noncultivated, in the North Central United States. The 137Cs concentration in watershed soils ranged from 56 to 149 nCi/sq m, with cultivated watersheds averaging 75 nCi/sq m, and noncultivated watersheds averaging 104 nCi/sq m. The 137Cs concentration in the reservoir sediments ranged from 74 to 1,280 nCi/sq m, with a mean of 676 nCi/sq m for the cultivated watersheds and 365 nCi/sq m for the noncultivated watersheds. The 137Cs concentrations per unit area in sediments were 0.8 to 18.7 times greater than those found in the contributing watershed soils. This indicated that some 137Cs is moving within the watersheds and that the reservoirs are acting as 'traps' or 'sinks.' The factors accounting for the variation in 137Cs concentration in the soils and sediments of the watersheds are (1) the erosion potential of the watershed, (2) the sites for adsorption of 137Cs, and (3) the input of radioactivity into the watershed. (Sims-ISWS)
W78-05779

EFFECTS OF SOIL, COVER CROP, AND NUTRIENT SOURCE ON AMOUNTS AND FORMS OF PHOSPHORUS MOVEMENT UNDER SIMULATED RAINFALL CONDITIONS,
Ohio Agricultural Research and Development Center. Wooster.
G. Y. Reddy, E. O. McLean, G. D. Hoyt, and T. J. Logan.
Journal of Environmental Quality, Vol 7, No 1, p 50-54, January-March 1978. 1 fig, 4 tab, 20 ref.

Descriptors: *Phosphorus, *Runoff, *Sediments, *Laboratory tests, Erosion, Soils, Soil erosion, Simulated rainfall, Fertilizers, Nutrients, Manure, Leachate, Water quality, Water pollution, Water pollution sources, Chemical, Chemical analysis, Crops, Agriculture, *Path of pollutants.

Three soils (Toledo silty clay, Rossmoyne silt loam, and Wauseon sandy loam) in greenhouse microplots were treated with chemical, chemical + straw, and manure sources of N, P, and K, were cropped or left bare, and were subjected to simulated rainfall. Phosphorus moving in runoff sediments, runoff solution, and leachate was measured. Most P moved as a component of sediments. Cropping decreased sediment and solution losses, while manure generally increased losses in both. Most P moving in runoff solution was inorganic. However, except where percolation swept inorganic P downward without reaction with the soil, most P moving in leachate was organic. Fractionations of soil P revealed that P treatments increased the HN4Cl- and NH4F-extractable fractions markedly, hadd less effect on the NaOH-extractable fraction, and had still less effect on the H2SO4-extractable and organic fractions. All phosphorus sources markedly increased the equilibrium P concentrations (EPC) of all soils. Manure increased EPC more than the other sources in the Rossmoyne and Wauseon soils. The tendency is for more sediment P to be lost from manure and for manure-treated soil to mobilize P into solution, make erosion control especially important if much manure is to be applied to soils and if eutrophication of surface waters is to be minimized. (Sims-ISWS)
W78-05780

AQUEOUS- AND SEDIMENT-PHASE PHOSPHORUS YIELDS FROM FIVE SOUTHERN PINE WATERSHEDS,
Southern Forest Experiment Station, Oxford, MS.
P. D. Duffy, J. D. Schreiber, D. C. McClurkin, and L. L. McDowell.
Journal of Environmental Quality, Vol 7, No 1, p 45-50, January-March 1978. 4 fig, 7 tab, 24 ref.

Descriptors: *Phosphorus, *Storm runoff, *Sediments, *Forests, *Mississippi, Pine trees, Watersheds(Basins), Erosion, Soil erosion, Soils, Sampling, Chemical analysis, Water quality, Sediment transport, Nutrients, Water pollution, Pollutants, Path of pollutants, Runoff, Drainage.

Stormflow from five reforested watersheds (1.5 to 2.8 ha) in northern Mississippi was analyzed during the 1974 water year (October 1973 to September 1974) for phosphorus (P) in solution and in association with suspended sediments. Samples were collected for each storm with Coshocton wheel samplers set below 0.91 -m H-flumes. For the year, mean concentration of total P in solution was 0.027 mg/liter for the five watersheds. Of this concentration, 45% was hydrolyzable P, 33% ortho-P, and 22% organic P. Sediment total P concentrations ranged from 274 to 1,067 micrograms/gram and were 2.0 to 8.9 times that in the watershed soils. Increased concentration of P in suspended sediment relative to soil was attributed to selective erosion of fine sediments and/or deposition of coarse sediments in transport. For the five watersheds, solution total P yield during the water year averaged 88 g/ha; whereas sediment total P yield averaged 210 g/ha and accounted for 64 to 76% of the sediment plus solution P yield. (Sims-ISWS)
W78-05781

TRANSPORT OF ATRAZINE AND SIMAZINE IN RUNOFF FROM CONVENTIONAL AND NO-TILLAGE CORN,
Ohio Agricultural Research and Development Center, Wooster.
G. B. Triplett, Jr., B. J. Conner, and W. M. Edwards.
Journal of Environmental Quality, Vol 7, No 1, p 77-84, January-March 1978. 1 fig, 7 tab, 25 ref.

Descriptors: *Herbicides, *Runoff, *Weed control, *Farm management, Storm runoff, Rainfall, Precipitation(Atmospheric), Corn(Field), Crops, On-site investigations, Sampling, Regression analysis, Correlation analysis, Data processing, Pollutants, *Path of pollutants, Water pollution, *Atrazine, *Simazine, No-tillage farms, Herbicide transport.

On a 0.4- to 3.5-ha watersheds, highest concentrations of atrazine (0.48 ppm) and simazine (1.2 ppm) were present in runoff occurring soon after application and declined rapidly for later events. Quantity of herbicides transported increased with the amount of runoff and was inversely related to the length of time between application and the runoff event. A maximum of 6% of the applied herbicide was transported from the field even under the most favorable conditions, and the average for all watersheds was less than 2%. Less runoff and herbicide loss occurred from areas planted to no-tillage than to conventional corn. In a multiple regression analysis of the factors, the natural logarithm (ln) of days after application and a tillage X application rate interaction were useful in predicting the natural logarithm of herbicide concentration in runoff. Factors from the multiple regression analysis used in this study were important in predicting concentration of atrazine and other pesticides when applied to data published by other workers. (Sims-ISWS)
W78-05782

EFFLUENTS FROM CATFISH PONDS DURING FISH HARVEST,
Auburn Univ., AL. Dept. of Fisheries and Allied Aquacultures.
For primary bibliographic entry see Field 5A.
W78-05783

EFFECTS OF DEICING SALTS ON WOODY VEGETATION ALONG MINNESOTA ROADS,
Minnesota Univ., St. Paul. Coll. of Forestry.
E. Sucoff.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-254 169, Price codes: A04 in paper copy, A01 in microfiche. Technical Bulletin 303-Forestry Series 20, Final report of Investigation No. 636, 1975. 49 p, 15 fig, 22 tab, 91 ref, 3 append.

Descriptors: *Salts, *Highways, Damages, *Vegetation, *Minnesota, Trees, Shrubs, Salt tolerance, Sodium chloride, Ice, Melt water, Runoff, Water pollution, Pollutants, Effects, Vegetation effects, Water pollution effects, Soil contamination effects, Path of pollutants, Salt spray, Soil salts, Deicing salts, Plant damage.

Information was collected on amounts of deicing salts used and methods of application. Planting practices and investment also were surveyed. Techniques were presented for the recognition of soil-salt and spray-salt damage using visual symptoms and chemical analysis of leaves and soils. Proof was obtained that salt causes much of the twig dieback in hardwoods and needle browning in pines observed along certain Minnesota roadways. The locations were defined as where salt-spray and soil-salt damage are likely to be high, moderate, or low. Species were rated for their sensitivity to soil-salts and winter spray-salts. A brief history of salt damage in Minnesota was presented, and the seriousness of current damage was evaluated in terms of mortality, reduced growth and disfigurement, and increased maintenance costs. Seven ways to reduce salt damage were presented, including a planting guide to match species to site. Future prospects were estimated for salt damage in Minnesota. A permanent plot system was described that will monitor build up in plant and soil sodium and chloride as well as changes in the vegetation caused by salt damage. (Sims-ISWS)
W78-05786

EFFECTS OF DEICING SALTS AND LEAD UPON TREES, SHRUBS AND SOILS IN CONNECTICUT,
Connecticut Dept. of Transportation, Wethersfield. Bureau of Planning and Research.
E. F. Button, E. J. Rubins, M. A. Woodward, and G. F. Griffin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 294, Price codes: A09 in paper copy, A01 in microfiche. Report FHWA-CT-76-9, January 1977. 163 p, 4 fig, 20 tab, 18 ref, 5 append.

Descriptors: *Damages, *Highways, *Salts, *Lead, *Connecticut, Vegetation, Vegetation effects, Trees, Shrubs, Salt tolerance, Sodium chloride, Water pollution, Water pollution effects, Soil properties, Soil chemistry, Soil contamination effects, Pollutants, Effects, Path of pollutants, Deicing salts, Salt concentrations, Plant damage.

The effects of deicing salts and particulate lead were studied on 28 species of trees and shrubs planted in 1968 and 1971 adjacent to a heavily travelled interstate roadway in central Connecticut. The soil on the same test site also was investigated for the accumulation of undesirable elements and their effects on its chemical and physical properties. Field observations, chemical analyses of plant tissues, tissue indices, and soils investigations all indicated that areas within 30 ft of the highway are unfavorable to the normal growth of many trees and shrubs. Consequently, trees and shrubs growing between 30 and 80 ft of the pavement were rated on their relative tolerance to roadside condition. The data supported the thesis that on well-drained sites under Connecticut conditions, deicing salts are being removed annually from the root-zone soil about as fast as they are being added. The data also suggested that trapping of lead particulates by vegetation bordering highways apparently results in an increase of lead in the underlying surface soils. Foliage may be effective in protecting areas immediately beyond the vegetative border from lead (Pb) fallout. (Sims-ISWS)
W78-05787

ORGANIC MATTER IN THE SUSPENDED LOAD OF THE RIVERS AND IRRIGATION SYSTEMS OF SOVIET CENTRAL ASIA,
I. A. Klyukanova.
Soviet Hydrology, Selected Papers, Vol 15, No 1, p 68-71, 1976. 4 tab, 14 ref. Translated from News of the USSR Academy of Sciences. Geographic Series (Izvestiya Akademii Nauk SSR. Seria Geograficheskaia), No 1, 1976, p 102-107.

Descriptors: *Organic matter, *Suspended load, *Rivers, *Asia, Canals, Sediment discharge, Data collections, Irrigation ditches, Surveys, On-site investigations, Foreign research, Foreign countries, Water pollution, *USSR.

The general patterns of variation in the content of organic matter in the strongly calcareous suspended load of the rivers and irrigation systems of Soviet Central Asia were investigated. The variation in the content of organic matter along the length of a river was given as a function of river load, and the annual discharge of organic substances by the major rivers of this region was computed. The suspensates were sampled in 1963-1973

in almost all the major rivers of Soviet Central Asia during the flood peak, and in the largest irrigation systems. Data on the absolute content of organic matter, obtained by multiplying the suspended particle concentration in the water, sediment discharge, and its volume by percentage content of organic matter, were presented. Study of the changes in the chemical composition of the suspended load of rivers (including organic matter) and irrigation-water suspensates has become one of the pressing problems in the geochemistry of suspensates. Successful solution of this problem probably will make it possible to use data on the changed chemical composition of suspended and irrigation sediments in a sound forecast of the probable changes in the agrochemical, physicochemical, and other properties of irrigated lands. (Humphreys-ISWS)
W78-05799

THE MIGRATION OF 238U, 226RA, 232TH AND 40K INTO FLOODPLAIN SOILS OF SUPERAQUATIC LANDSCAPES OF THE BITYUG RIVER, (IN RUSSIAN),
Moscow State Univ. (USSR). Dept. of General Soil Science.
M. T. Yastrebov.
Vestn Mosk Univ Biol Pochvoved 31(2), p 83-86, 1976.

Descriptors: Flood plain soils, Landscapes, Migration, *Potassium-40, *Radium-226, Rivers, Soils, *Thorium-232, *Uranium-238, USSR, *Bityug River(USSR), *Chermozem, Humus, Gleys, Radioisotopes, Path of pollutants.

Meadow-swamp soddy-meadow and chernozemic-meadow soils of the superaquatic calcic-magnesium sodic landscapes in the floodplain Bityug River (USSR) contain 1.8-4.1 times more 238U than the typical chernozems of the correlated trans-eluvial calcic landscapes. 238U is accumulated in humus and gley horizons of flood plain soils. A more narrow ratio 232Th: 238U in the floodplain soils (1.1-2.5), than in the typical chernozems (2.3-4.8) indicate the mirgation of 238U into the floodplain soils. Migration of the 226Ra, 232Th and 40K into the investigated floodplain soils was not established.--Copyright 1977 Biological Abstracts, Inc.
W78-05822

BIOLOGICAL ACTIVITY OF SODDY-PODZOLIC SOILS UNFLOODED AND FLOODED BY THE WATER OF MOZHAISK RESERVOIR, (IN RUSSIAN),
Moscow State Univ. (USSR). Dept. of Physics; and Moscow State Univ. (USSR). Dept. of Soil Melioration.
For primary bibliographic entry see Field 2G.
W78-05827

NO METAL UPTAKE BY CORN OR GRASS.
For primary bibliographic entry see Field 5E.
W78-05853

EFFECTS OF INCUBATION AND LIMING ON YIELD AND HEAVY METAL UPTAKE BY RYE FROM SEWAGE-SLUDGED SOIL,
Agricultural Research Service, Beltsville, MD.
For primary bibliographic entry see Field 5E.
W78-05863

CHEMICAL INTERACTION IN PARTICAL SEPARATION,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
For primary bibliographic entry see Field 5D.
W78-05865

THE USE OF FAECAL BACTERIA AS A TRACER FOR SEWAGE SLUDGE DISPOSAL IN THE SEA,
Ministry of Agriculture, Fisheries and Food, Burnham-on-Crouch (England). Fisheries Lab.
P. A. Ayres.
Marine Pollution Bulletin, Vol 8, No 12, p 283-285, December, 1977. 2 fig, 4 ref.

Descriptors: *Bioindicators, *Path of pollutants, *Coliforms, *Sewage disposal, *Sewage bacteria, *Tracking techniques, *E coli, Analytical techniques, Sludge disposal, Sampling, Membrane processes, Water pollution control, Monitoring, On-site data collections, Waste water disposal, *Liverpool Bay(England), Bays.

The movement of sewage sludge discharged into Liverpool Bay in England was followed using bacteria indigenous to sewage as a tracer. Enumeration of E. coli and other enterobacteria associated with fecal waste was accomplished within two days for samples of bottom sediment collected from 62 sites in Liverpool Bay. Initial concentrations of coliforms in the sediment samples proved higher than E. coli concentrations, indicating greater survival of coliform bacteria over a large area. Movement of the bacteria demonstrated a definite easterly direction towards the River Mersey and rising tide; little northerly or southerly movement was observed. Previous studies with radioactive tracers had yielded similar results and indicated rapid dispersion with east-west settlement over an area 8-km wide by 30-km long. Fecal bacteria was found to collect in muddy sediments and had a short viability in seawater. (Lisk-FIRL)
W78-05876

A FAECAL STEROL SURVEY IN THE CLYDE ESTUARY,
Bristol Univ. (England). Dept. of Chemistry.
R. M. Goodfellow, J. Cardoso, G. Eglinton, J. P. Dawson, and G. A. Best.
Marine Pollution Bulletin, Vol 8, No 12, p 272-276, December, 1977. 2 fig, 5 tab, 21 ref.

Descriptors: *Path of pollutants, *Pollutant identification, *Alcohols, *Sewage disposal, *Estuaries, *Europe, Gas chromatography, Surveys, Analytical techniques, Measurement, Sewerage, Waste water disposal.

Various tracer techniques have been used to map the movement of sewage effluents discharged from ocean outfalls. In this study, gas chromatography was used to measure levels of coprostanol in water and sediments collected in the Clyde estuary and Firth of Clyde in England. Bottom sediments contained 0.1-14.0 ppm of coprostanol (5beta-cholestan-3beta-ol), as well as the corresponding 24-methyl- and 24-ethyl-5beta-stanols. The concentrations of coprostanol in seawater closely parallelled fecal coliform counts obtained for the seawater samples. Coprostanol levels were also directly related to the discharge locations and quantities of sewage input to the estuary by sewage outfalls and dumping operations. The data indicated that fecal steroid levels in sewage were rapidly diluted after discharge, although they could be detected in surface waters over 20 km from the sewage outfalls. The results suggested that coprostanol data might be used in addition to fecal coliform enumeration for monitoring the path of pollutants, especially for detecting domestic wastes in industrial outfalls where the concentration of sewage bacteria is generally low. (Snyder-FIRL)
W78-05879

DISTRIBUTION OF VIRAL AND BACTERIAL PATHOGENS IN A COASTAL CANAL COMMUNITY,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
C. P. Gerba, S. M. Goyal, E. M. Smith, and J. L. Melnick.
Marine Pollution Bulletin, Vol. 8, No. 12, p 279-282, December, 1977. 1 fig, 3 tab, 18 ref.

Descriptors: *Path of pollutants, *Pathogenic bacteria, *Viruses, *Canals, *Pollutant identification, Distribution patterns, Sewage treatment, Biological treatment, Treatment facilities, Activated sludge, Municipal wastes, Waste water disposal, Waste water treatment.

In canal communities, each house has canal frontage allowing direct water access. The occurrence and distribution of bacterial and viral pathogens were examined in a canal community on the Texas Gulf coast where secondary-treated sewage effluent was discharged. Turbidity and salinity, as well as bacteria and viruses, were measured. Sewage from the community is treated in a small activated sludge plant which discharges an unchlorinated effluent. Recommended limits of 1000 total coliforms/100 ml and 200 fecal coliforms/100 ml for recreational water were exceeded in two of the three monthly samples. Salmonella, poliovirus, and Echovirus types 1, 2, and 3 were also isolated. Assuming an average virus concentration efficiency of 50%, the recommended standard for recreational water of one infectious unit of virus per 10 gallons was exceeded in all water samples. (Snyder-FIRL)
W78-05880

INFLUENCE OF ARTIFICIAL DRAINAGE ON PENETRATION OF COLIFORM BACTERIA FROM SEPTIC TANK EFFLUENTS INTO WET TILE DRAINED SOILS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
R. B. Reneau, Jr.
Journal of Environmental Quality, Vol. 7, No. 1, p 23-30, January-March, 1978. 4 fig, 6 tab, 14 ref.

Descriptors: *Path of pollutants, *Coliforms, *Loam, *Monitoring, *Water table, *Septic tanks, Sampling, Domestic wastes, Flow, Test wells, Tile drains, Tile drainage, Waste water treatment, Virginia, Analytical techniques.

The movement of fecal and total coliform bacteria through tile drained soil systems from domestic septic tanks was monitored with on-site analytical techniques in Windsor, Virginia. The residential study area was characterized by poorly drained Aeric and Typic Ochraqualts soil that had been previously tile drained for agricultural purposes. Sampling monitors were oriented in the direction of the groundwater flow; water table control wells and tile outfalls were established at various distances from the three sites. Log normalized fecal coliform densities for high water tables reached a mean high of 160,000/100 ml in the third site at 152 cm from the septic source. Fecal counts for three sites at distances of 1,310, 1,341, and 2,172 cm from the sewage sources were reduced to a minimum of less than 3.0/100 ml. The highest mean total coliform density recorded at site three of 730,000/100 ml at 152 cm was reduced to a density of 38/100 ml at the maximum distance from the source. A high of greater than 240,000/100 ml for total coliform density and a low of less than 3.0/100 ml for fecal coliform density were observed in the tile outfalls for high water tables. Coliform counts increased during the summer low water tables. (Lisk-FIRL)
W78-05881

NEARSHORE SEDIMENT POLLUTION IN ISRAEL BY TRACE METALS DERIVED FROM SEWAGE EFFLUENT,
Hebrew Univ. of Jerusalem, Rehovot (Israel). Dept. of Soil and Water Science.
A. J. Amiel, and J. Navrot.
Marine Pollution Bulletin, Vol. 9, No. 1, p 10-14, 1978. 5 fig, 9 ref.

Descriptors: *Sediments, *Sea water, *Trace elements, *Copper, *Outfall sewers, Silver, Cobalt,

Chromium, Mercury, Nickel, Lead, Zinc, Cadmium, Bacteria, Marine fish, Waste water disposal, Municipal wastes, Waste dilution, *Israel.

Marine sediment from the Israeli coast in the vicinity of a sewage outfall was analyzed for silver, copper, chromium, cobalt, mercury, nickel, lead, and zinc. Both total and extractable trace metal measurements were recorded for sediment core samples. Trace metal concentrations were found to be a function of distance from the sewage outfall, with the highest accumulations recorded near the pipeline outlet. Significant trace metal concentrations were found within 400 meters from the shoreline and sewage pipe. Beyond the 400 meter distance, dilution reduced the trace metal concentrations. Dilution of bacteria was limited near the outfall and increased progressively with distance from the pipe. Trace metal concentrations in sediment collected at a significant distance from the outfall were similar to concentrations in non-polluted areas. Maximum trace metal levels were recorded during the summer months and in the upper layers of the sediment. A previous study of the outfall area indicated concentrations of cadmium and copper at a level considered potentially dangerous to aquatic organisms. (Lisk-FIRL)
W78-05887

TRACE METAL DISTRIBUTIONS AMONG THE HUMIC ACID, THE FULVIC ACID, AND PRECIPITABLE FRACTIONS EXTRACTED WITH NAOH FROM SEWAGE SLUDGES,
California Univ., Riverside. Dept. of Soil and Environmental Science.
For primary bibliographic entry see Field 5A.
W78-05888

THE USE AND INTEGRATION OF GROUND AND SURFACE WATER MODELS IN THE 208 PLANNING PROCESS,
Battelle Pacific Northwest Labs., Richland, WA.
J. R. Raymond.
AIChE Symposium Series, Vol. 73, No. 167, p 319-327, 1977. 10 fig, 13 ref.

Descriptors: *Computer models, *Hydraulic models, *Surface-groundwater relationships, *Long-term planning, *Analytical techniques, Hydrology, Groundwater, Surface waters, Legislation, Water supply, Waste treatment, Waste water disposal.

Section 208 of the Federal Water Pollutin Control Act Amendments of 1972 requires waste treatment management planning for areas with substantial water quality problems. The impact, interrelationships, and treatment alternatives must be identified and assessed for complex waste sources which may affect water quality. Waste treatment needs must be projected over a period of 20 years. Numerical hydrologic models and associated models for pollutant transport are important planning tools, allowing complex interrelationships between surface and groundwater quality, water supply, waste discharge, waste water treatment, and treatment alternatives to be assessed. The hydralic and transport theories are well developed; equations exist which can be solved by existing computers to describe the systems. The development of a model to provide accurate assessments requires considerable hard data and knowledge of system parameters and boundaries. Because of the cost, time, and technology required, numerical modelling should be limited to complex problems where simpler methods are insufficient. (Snyder-FIRL)
W78-05895

STUDY OF THE CONTAMINATION OF MARINE CULTURES, (IN FRENCH),
Centre d'Etudes et de Recherches de Biologie et d'Oceanographie Medicale, Nice (France).
J. Aubert, G. Flatau, D. Puel, V. Breittmayer, and R. Clement.
Rev Int Oceanogr Med 45/46, p 77-98, 1977.

Descriptors: Chemical wastes, *Microbiological studies, *Toxicity, Water quality, *Marine pollution, *Path of pollutants, *Monitoring.

Chemical and microbiological pollution resulting from agricultural, industrial and urban sources were monitored in water and in organisms of 6 marine experimental aquaculture centers and of a marine zoo. Pollutant concentrations were lower than the admitted levels. Microbiological quality of organisms was apparently related to the biological quality of water.--Copyright 1978, Biological Abstracts, Inc.
W78-05897

UNDERGROUND INJECTION OF LIQUID WASTE CAN BE ENVIRONMENTALLY SOUND,
Texas Water Quality Board, Austin.
For primary bibliographic entry see Field 5E.
W78-05899

BEHAVIOR OF ANIONIC SURFACTANTS IN A SOIL-SEWAGE EFFLUENT SYSTEM,
Agricultural Research Organization, Bet Dagan (Israel). Inst. of Soils and Water.
A. J. Acher, and B. Yaron.
Journal of Environmental Quality, Vol. 6, No. 4, p 418-420, October-December, 1977. 5 fig, 2 tab, 11 ref.

Descriptors: *Surfactants, *Soil chemistry, *Sewage effluents, *Adsorption, *Soil contamination, Pollutant identification, Soils, Microbial degradation, Municipal wastes, Waste water disposal, Waste water treatment.

The absorption and desorption of anionic surfactants by soil during the application of water and sewage effluents was investigated. Sodium lauryl sulfate (NaLS), dodecyl benzene sulfonate sodium salt (DDBS), and linear alkyl aryl sulfonate (LAS) were applied in 1% aqueous solutions to a sandy regosol from Mivtachim, Israel and a clay grumusol from Tel Adashim, Israel. The soil was mixed with a combination of the anionic surfactant solution and sewage effluent from Nazareth or Haifa, Israel. The concentration of anionic surfactants was measured with the methylene blue active substances (MBAS) method. The affinity of the soil was lowest for DDBS and higher for NaLS. Microbial attack during adsorption from sewage effluent raised the soil's apparent adsorption capacity. The adsorption isotherms of the ionic surfactants were linear and the soil type controlled the rate of accumulation. The soil-adsorbed NaLS was completely fixed and could not be desorbed. The desorption rate of DDBS and LAS from soil was controlled by the initial concentration. (Snyder-FIRL)
W78-05900

IMPROVING SUBSURFACE DISPOSAL SYSTEM PERFORMANCE,
Agricultural Research Center, Beltsville, MD.
For primary bibliographic entry see Field 5E.
W78-05901

NITRATE LEACHING DURING LONG-TERM SPRAY IRRIGATION FOR TREATMENT OF SECONDARY SEWAGE EFFLUENT ON WOODLAND SITES,
Pennsylvania State Univ., University Park. Dept. of Agronomy.
J. E. Kook, and L. T. Kardos.
Journal of Environmental Quality, Vol. 7, No. 1, p 30-34, January-March, 1978. 5 fig, 3 tab, 16 ref.

Descriptors: *Return flow, *Sewage wastes, *Nitrates, *Leaching, *Soil water, Forests, Hardwood, Surface irrigation, Rates of application, Recirculated water, Waste water treatment, Municipal wastes.

Studies were conducted at two forested areas irrigated with 5 cm of waste water to evaluate long-term effects of sewage effluent land applications on nitrate leaching. A hardwood forest received an average annual effluent loading of 293 kg/acre over a nine-year period. The study indicated that 83% of the total nitrate, more than 2,000 kg/acre, had leached from the hardwood site in six of the nine years. Analyses of the soil water at a depth of 120 cm showed an average nitrate concentration of 15 mg/liter, with a high of 30 mg/liter recorded during the latter part of 1969 and early 1970. Little nitrate reduction was achieved by dividing effluent applications into 2.5 cm twice weekly or reducing irrigation to 2.5 cm weekly. Nitrate concentrations at the 120-cm depth remained above the potable water nitrate limit of 10 mg/liter. A white spruce forest planted in well-drained clay loam was irrigated weekly with 5 cm of effluent over 9 months of the year beginning in 1963. Analyses of the soil water nitrate content at a depth of 120 cm showed an average concentration of less than 10 mg/liter. A total of 36% of the nitrate had leached from the site between the sixth and ninth years of the study. An increase in the rate of effluent irrigation to 7.5 cm/week resulted in a 75% leaching rate, with nitrate concentrations exceeding 10 mg/liter at the 120 cm depth. (Lisk-FIRL)
W78-05903

DISCHARGE OF NITROGEN, PHOSPHORUS AND ORGANIC MATTER INTO THE GULF OF BOTHNIA,
National Swedish Environment Protection Board, Uppsala. Limnological Survey.
T. Ahl, A. Haverinen, L. Thorell, and J. Wartiovaara.
Ambio, Vol 6, No 5, p 273-275, 1977. 4 fig, 1 tab, 12 ref.

Descriptors: Path of pollutants, Water pollution sources, *Nitrogen, *Phosphorus, *Biochemical oxygen demand, *Oceans, *Rivers, Drainage area, Watersheds(Basins), Municipal wastes, Industrial wastes, Waste water treatment, *Gulf of Bothnia(Finland).

Sources and quantities of nitrogen, phosphorous, and organic matter discharged into the Gulf of Bothnia, feeder to the Baltic Sea, from Sweden and Finland were calculated. Major sources of nitrogen, phosphorus, and organic matter were determined to be rivers, municipal waste waters, and industrial waste waters. A total of more than 81,000 tons/yr of nitrogen in the form of ammonia, nitrite, nitrate, and organic matter was discharged into the gulf, 90% from rivers. The total quantity of inorganic nitrogen discharged was 22,000 tons and organic was 59,000 tons. A total of 6,200 tons/yr of phosphorus was released with under 5,000 tons from rivers, more than 600 tons from municipal waste waters, and more than 700 tons from industrial wastes. About 56% of the total phosphorus was organic, with the remainder being inorganic phosphate. An estimated 600,000 tons/year of 7-day BOD was discharged, with 54% contributed by industrial waste waters and 43% from rivers. The 7-day BOD loading on the Gulf of Bothnia was calculated at 5.16 g/sq m/yr. Bothnian Bay loading was estimated at 6.58 g/sq m/yr, and 4.51 g BOD/sq m/yr in the Bothian Sea. (Lisk-FIRL)
W78-05905

THE PROBLEM OF POLLUTION IN THE MONTPELLIER REGION, (IN FRENCH),
L. Berner.
Bull Soc Linn Provence 28, p 23-32, 1975.

Descriptors: *Bioindicators, Water pollution effects, *Lez River(France), Path of pollutants, Environmental effects.

Animal and plant indicators show that the development of pollution of the Lez river, in the Montpellier region, from its source (where it is potable) to

its mouth (where it is heavily polluted) corresponds to the degradation of the environment of the region.--Copyright 1978, Biological Abstracts, Inc.
W78-05906

COASTAL WATER RESEARCH PROJECT. ANNUAL REPORT FOR THE YEAR ENDED 30 JUNE 1977.
Southern California Coastal Water Research Project, El Segundo.
Annual Report for the Year Ended 30 June 1977. 257 p, 3 append.

Descriptors: *Baseline studies, *Environmental effects, *Resources development, *Water resources, California, Waste water disposal, DDT, Polychlorinated biphenyls, Heavy metals, Toxicity, Outfall sewers, Sediments, Diseases, Bottom sediments, Pacific Ocean, *Outer Continental Shelf, *Southern California Bight, Petroleum development, Chlorinated hydrocarbons, Fin erosion, Dichlorobenzene.

Twenty-eight professional papers make up this annual report. Each paper prepared by individual scientists, covers research that was outlined in the Research Plan for 1977 and describes when, where, and how the scientific work was done as well as what was discovered. The following topics are covered: Recent data on possible pollutants contributed to southern California's open coastal waters by various sources, especially including details about municipal wastewaters; new information about how the discharged material is distributed by water motions; new findings about animal and plant populations; studies of the levels of pollutant materials in animals; the levels at which metals and chlorinated hydrocarbon pollutants become toxic to marine life as determined by tests; and evidence of actual effects on animals in the ocean. (See W78-05912 thru W78-05930) (Sinha - OEIS)
W78-05911

CHARACTERISTICS OF MUNICIPAL WASTEWATER DISCHARGES, 1976,
Southern California Coastal Water Research Project, El Segundo.
H. A. Schafer.
In: Southern California Coastal Water Research Project Annual Report for the Year Ended 30 June 1977, p 19-23, 1977. 4 tab.

Descriptors: *California, *Water pollution sources, *Heavy metals, *Baseline studies, Environmental effects, *Resources development, *Water resources, Municipal wastes, Waste water, DDT, Polychlorinated biphenyls, Outer Continental Shelf, *Petroleum development, Chlorinated hydrocarbons.

Municipal wastewater discharges are the principal source of most pollutants entering the southern California waters as a result of human activity. The data for 1976 are summarized in three tables. The summary indicates that, although the flow of municipal wastewater has increased by approximately 10% in the last 5 years, the mass emission of several of the waste constituents have been reduced. Most notable is the significant decline in the discharge of DDT and PCB chlorinated hydrocarbons. Notable changes between 1975 and 1976 include the following: The Hyperion 7-mile outfall selenium mass emission rate is twice the amount of any previous year. Silver showed a 17% increase between 1974 and 1975, but the 1976 mass emission rate was lower than for any year since 1971. Arsenic, cadmium, copper, lead and zinc values showed some increase. (See also W78-05911) (Sinha - OEIS)
W78-05912

METALS IN POWER PLANT COOLING WATER DISCHARGES,
Southern California Coastal Water Research Project, El Segundo.
D. R. Young, T-K. Jan, and M. D. Moore.
In: Southern California Coastal Water Research Project Annual Report for the Year Ended 30 June 1977, p 25-31, 1977. 2 ref.

Descriptors: *Baseline studies, *Environmental effects, *Resources development, *Water resources, *Cooling water, *Powerplants, *Metals, Water pollution sources, Heavy metals, Electric powerplants, California, Outer Continental Shelf, Petroleum development, Southern California Bight.

Cooling water from coastal power plants is the largest type of discharge to the Southern California Bight. The average annual flow from the fifteen major electrical generating stations in southern California during 1970-71 was 7.7 x 10 to the 12th power liters/year, approximately seven times the corresponding rate for municipal wastewater discharged via submarine outfalls. There has been growing concern that these very large thermal discharges could be raising the levels of certain toxic trace metals, such as copper, in the nearshore waters. An investigation into the levels of six trace metals in both seawater influent and effluent of eight major generating statons located along the Ventura, Los Angeles, and Orange County coastlines was conducted. Findings to date indicate that, although increased levels of some metals are found in certain nearshore regions (particularly harbors), the power plants studied do not appear to be an important source (See also W78-00511) (Sinha - OEIS)
W78-05913

HALOGENATED HYDROCARBONS IN WASTEWATERS: KNOWNS AND UNKNOWNS,
Southern California Coastal Water Research Project, El Segundo.
T. C. Heesen, and D. R. Young.
In: Southern California Coastal Water Research Project Annual Report for the Year Ended 30 June, p 33-38, 1977. 2 fig, 3 tab, 3 ref.

Descriptors: *Baseline studies, *Environmental effects, *Resources development, *Halogenated pesticides, Water pollution sources, Pollutant identification, Polychlorinated biphenyls, DDT, Outer Continental Shelf, Southern California Bight, Low-molecular-weight halogenated hydrocarbons(LMHH).

The data are in agreement with a conclusion reported last year--that the sum of the measureable DDT and PCB residues (which make up most of the effluent monitoring total identifiable chlorinated hydrocarbon values) are generally an order of magnitude below the level of total chlorinated benzenes in these municipal wastewaters. Recent pilot studies of the Hyperion 5-mile effluent (whose 350-mgd flow accounts for about one-third of the municipal wastewater discharged to the Bight) suggest that the level of low-molecular-weight halogenated hydrocarbons (LMHH) is one order of magnitude above that of the chlorinated benzenes, and two orders of magnitude above that of the DDT/PCB residues generally reported to regulatory agencies as total identifiable chlorinated hydrocarbons. (See also W78-05911) (Sinha - OEIS)
W78-05914

IN SITU MEASUREMENTS OF INITIAL DILUTION,
Southern California Coastal Water Research Project, El Segundo.
T. J. Hendricks.
In: Southern California Coastal Water Research Project Annual Report for the Year Ended 30 June 1977, p 41-51, 1977. 4 fig, 2 ref.

Descriptors: *Baseline studies, *Environmental effects, *Resources development, *Water pollution sources, *Path of pollutants, *Waste water(Pollution), Outfall sewers, California, Outer Continental Shelf, Southern California Bight, Dilution, In-situ measurements.

Initial dilution processes at the four major ocean outfalls in the southern California area were studied to (1) compare various methods of predicting initial dilution, measure the actual dilutions produced by existing outfall systems, and compare the predicted and actual performances; (2) examine the behavior of buoyant plumes and surface wastefields in the sea; and (3) determine the suitability of various tracers for field studies of plume and wastefield behavior. Results to date indicate that the 'minimum initial dilutions' ranged from a low of 100:1 to a high of 290:1 for the well-stratified conditions existing during October 1976. Measurements at the four major outfalls during a period of strong stratification indicate that initial dilutions of effluents are significantly higher than predicted by numerical models, which neglect the influence of ambient ocean currents. Ammonia and Rhodamine WT dye dilutions were essentially equivalent, in relatively good agreement with limited bacterial comparisons, but significantly greater than estimates based on turbidity. (See also W78-05911) (Sinha-OEIS)
W78-05915

COASTAL CURRENTS,
Southern California Coastal Water Research Project, El Segundo.
T. J. Hendricks.
In: Southern California Coastal Water Research Project Annual Report for the Year Ended 30 June 1977, p 53-62, 1977. 5 fig, 3 ref.

Descriptors: *Baseline studies, *Environmental effects, Resources development, *Water pollution sources, *Currents(Water Waste water(Pollution), Outfall sewers, California, *Outer Continental Shelf, *Southern California Bight, Pollutant transport, Subthermocline water.

During 1976, current meter and drogue studies were carried out in the San Diego area. The objectives of this work were (1) to determine the mean speed and direction of subthermocline currents over a period of a year, (2) to examine the long-term variability in these currents, (3) to determine the length of the segment of coast that can be described by the currents recorded at a single location, and (4) to explore possible correlations between these currents and winds and tides. During the year, short-duration measurements of currents were made at several depths in the water column near four southern California municipal wastewater outfalls as part of the continuing studies of initial dilution of wastewater discharges. The mean notion of the subthermocline currents in the area of the Point Loma outfall over a 290-day period was upcoast at a speed of 3 cm/sec. This net upcoast motion is in agreement with the distribution of effluent-related sediments in this area and, in fact, with the distribution of sediments off the Whites Point outfall as well. If this mean flow continued along the entire coast between Mexico and Point Conception, it would correspond to a transit time for that region of about 150 days. (See also W78-05911) (Sinha-OEIS)
W78-05916

POLLUTANTS IN SEDIMENTS OFF PALOS VERDES,
Southern California Coastal Water Research Project, El Segundo.
G. P. Hershelman, T-K. Jan, and H. A. Schafer.
In: Southern California Coastal Water Research Project Annual Report for the Year Ended 30 June 1977, p 63-68, 1977. 3 fig, 6 ref.

Descriptors: *Baseline studies, *Environmental effects, Resources development, *Water pollution

sources, *Sediments, *Heavy metals, DDT, Polychlorinated biphenyls, Water pollution, Paths of pollutants, Outfall sewers, *Outer Continental Shelf, Southern California Bight.

Concentrations of eight metals, DDT, and PCB in the surface sediments at 44 stations off Palos Verdes Peninsula were determined and are reported. To evaluate the degree to which submarine discharges have altered conditions around outfalls, it is necessary to determine corresponding baseline values. In spite of the differences between sampling sites, the ranges of the baseline concentrations are generally quite similar. The highest values for most of the metals are about an order of magnitude lower than concentrations in outfall sediments in the area extending 5 km to the northwest of the JWPCP outfalls. (See also W78-05911) (Sinha-OEIS)
W78-05917

PRECISION OF CHLORINATED HYDROCARBON MEASUREMENTS,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5A.
W78-05918

SATELLITE IMAGERY STUDIES,
Southern California Coastal Water Research Project, El Segundo.
T. J. Hendricks.
In: Southern California Coastal Water Research Project Annual Report for the Year Ended 30 June 1977, p 75-78, 1977. 2 fig, 1 ref.

Descriptors: *Baseline studies, *Environmental effects, Resources development, *Water pollution sources, Remote sensing, Satellites(Artificial), Water circulation, California, *Outer Continental Shelf, *Southern California Bight, Pollutant transport, Satellite imagery.

The possibility of using remote sensing, particularly satellite imaging, to obtain information on the surface water circulation within the Southern California Bight is explored. As imagery is collected and analyzed, the sequential development and movement of the thermal patterns can be observed and the validity of these inferences can be tested. From this imagery, a conceptual model of the circulation of the surface water within the Bight might be developed and perhaps insight can be gained into the sources of the long-period fluctuations observed in nearshore shelf current meter records. (See also W78-05911) (Sinha-OEIS)
W78-05919

CHLORINATED BENZENES IN PALOS VERDES FLATFISH,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5C.
W78-05920

METALS IN SEAFOODS NEAR OUTFALLS,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5C.
W78-05921

METALS IN MUSSELS FROM HARBORS AND OUTFALL AREAS,
Southern California Coastal Water Research Project, El Segundo.
D. R. Young, and G. V. Alexander.
In: Southern California Coastal Water Research Project Annual Report for the Year Ended 30 June 1977, p 159-165, 1977. 1 fig, 2 tab, 6 ref.

Descriptors: *Baseline studies, *Environmental effects, Resources development, *Water pollution sources, *Water pollution effects, *Heavy metals, Bioindicators, Outfall sewers, Mussels, Paints, California, Outer Continental Shelf, Southern California Bight, Trace metals, Mytilus edulis.

Abnormally high levels of a number of potentially toxic trace metals in tissues of bay mussels (Mytilus edulis) collected from areas of either vessel activities or municipal wastewater discharges are reported. Ship and boat protective paints constitute a potentially significant source of certain trace metals to coastal marine waters. For example, copper, mercury, and tin have been used extensively as toxicants in antifouling paints, and chromium, lead and zinc are important components of bottom primers. Cadmium also occurs in certain paint pigments, and zinc is utilized in the sacrificial anodes that are attached to vessel bottoms to prevent corrosion of metal parts. The results of this study indicate that the use and maintenance of recreational, commercial, and naval vessels, as well as the submarine discharge of municipal wastewater, are sources of trace metal additions to intertidal organisms of the Southern California Bight. (See also W78-05911) (Sinha - OEIS)
W78-05922

A SAFE LEVEL OF HEXAVALENT CHROMIUM FOR A MARINE POLYCHAETE,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5C.
W78-05923

EFFECTS OF HEXAVALENT CHROMIUM ON SEA URCHIN EMBRYOS AND BRITTLE STARS,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5C.
W78-05924

TOXICITY OF A CHLORINATED BENZENE TO SEA URCHIN EMBRYOS,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5C.
W78-05925

MARINE BIRD DEATHS AT LOS ANGELES ZOO,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5C.
W78-05926

ANIMALS THAT ARE INDICATORS OF MARINE POLLUTION,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5C.
W78-05927

HISTOLOGY OF LIVER TISSUE FROM DOVER SOLE,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5C.
W78-05928

FIN EROSION DISEASE AND LIVER CHEMISTRY: LOS ANGELES AND SEATTLE,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5C.
W78-05929

FIN REGENERATION IN DOVER SOLE,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5C.
W78-05930

HYDROGEOLOGY OF THE LAKE METIGOSHE BASIN NORTH DAKOTA AND MANITOBA,
North Dakota Univ., Grand Forks. Dept. of Geology; and Geological Survey, Grand Forks, ND.
S. R. Moran.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 638, Price codes: A04 in paper copy, A01 in microfiche. North Dakota Water Resources Research Institute, Fargo, Completion Report, Part 1, Research Report WI-221-043-77, May 1977. 59 p, 10 fig, 3 tab, 19 ref, 2 append. OWRT A-034-NDAK(1). 14-31-0001-5034.

Descriptors: Baseflow, Groundwater, Recharge, *Nutrients, Lake basins, Seepage, Lakes, Water quality, Groundwater movement, Hydrogeology, *Canada, Watershed management, Recreation wastes, *Water pollution sources, Water pollution effects, *North Dakota, Manitoba, *Lake Metigoshe Watershed(ND-Manitoba), Turtle Mountains.

Lake Metigoshe has been extensively developed as one of the most important recreational lakes in Central North Dakota. With such heavy use, the nutrient level of the lake has risen to a level where growth of planktonic algae and rooted plants have detrimentally affected recreational use of the lake. This study is part of a multi-disciplinary effort to discover the sources from which and the mechanisms by which excess nutrients were entering the lake. On the basis of the data obtained in this study it is not possible to determine the origin of the nutrients that Downing (1975) found entering the lake through the groundwater.
W78-05933

PHOSPHORUS DYNAMICS IN SOILS IRRIGATED WITH MUNICIPAL WASTEWATER,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 5D.
W78-05937

CRITERIA FOR THE USE OF VERTICAL AVERAGING IN GREAT LAKES DISPERSION MODELS,
Cleveland State Univ., OH. Dept. of Chemical Engineering.
F. M. Galloway, Jr, and S. J. Vakil.
Journal of Great Lakes Research, Vol. 3, No. 1-2, p 20-28, October 1977. 9 fig, 2 tab, 13 ref. OWRT A-036-OHIO(3).

Descriptors: *Dispersion, *Lake Erie, *Lake Ontario, *Great Lakes, *Model studies, Mathematical models, Lakes, Circulation, Water circulation, Mixing, Diffusion, Pollutants, *Path of pollutants, Water pollution, Flow, Currents(Water), Velocity, Limnology, *Dispersion models.

Two basic questions that arise in the development of Great Lakes dispersion models are (1) when can vertical averaging be used to reduce the dimensionality of the problem, and (2) what value(s) should be used for the horizontal dispersion coefficient(s). A strategy was presented for estimating answers to both questions. Application of the strategy was illustrated using dispersion modeling in the Western Basin of Lake Erie as an example. Predicted values for the horizontal effective dispersion coefficient also were compared with some previous measurements of horizontal dispersion in Lake Ontario. (Sims-ISWS)
W78-05947

EFFECTS OF POLLUTANTS ON NATALITY OF MUSCULIUM SECURIS (BIVALVIA:PISIDIIDAE),
Guelph Univ., (Ontario). Dept. of Zoology.

For primary bibliographic entry see Field 5C.
W78-05956

THE CYCLE OF HEAVY METALS IN LAKES, (IN GERMAN),
Eidgenoessische Anstalt fuer Wasservorsorgung, Abwasserreinigung und Gewaesserschutz, Kastienbaum (Switzerland). Seenforschungslab.
P. Baccini.
Schweiz Z Hydrol 38(2), p 121-158, 1976.

Descriptors: *Heavy metals, *Lake sediments, Mesotrophy, Biomass, Lakes, *Model studies, Sedimentation, Switzerland, *Lake Lucerne(Switz), *Path of pollutants.

In mesotrophic Lake Lucerne (Bay of Horw) (Switzerland) and in eutrophic Lake Alpnach concentration and sedimentation of Fe, Cu, Zn, Cd and Pb were investigated as a function of time and depth, and compared with a series of physical and chemical parameters. A metal balance was made for the Lake Alpnach. A model for the distribution of the metals between biomass, allochthonous material and dissolved phase was employed. Phenomenology and the model indicate that the sedimentation of the metals is dominated by allochthonous particles, the biogenic particularization is partially reversed by lake internal decomposition processes and the trace metals reaching the sediment ar partially redissolved.--Copyright 1978, Biological Abstracts, Inc.
W78-05962

PHOSPHORUS LOADING AND RESPONSE IN LAKE VANERN NEARSHORE AREAS,
National Swedish Environmental Protection Board, Uppsala.
For primary bibliographic entry see Field 5C.
W78-05966

BACTERIAL CONTAMINATION OF LAKE POWELL WATERS: AN ASSESSMENT OF THE PROBLEM,
New Mexico Univ., Albuquerzque. Dept. of Biology.
D. E. Kidd.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-261 682, Price codes: A03 in paper copy, A01 in microfiche. Report NSF-RA-E-75-184, Lake Powell Research Project Bulletin Number 16, December 1975. 32 p, 2 fig, 17 tab, 11 ref. NSF AEN 72-03462 A03.

Descriptors: *Lake Powell(Ariz-Utah), *Coliforms, *Water pollution, *Bacteria, *Water quality standards, *Public health, Reservoirs, Recreation, Swimming, Potable water, Mathematical models, Shigella, Salmonella, Streptococcus, Lake Powell Research Project, Diseases, Hazards, Utah, Arizona, Colorado River.

Analysis of water samples taken from Lake Powell in Utah and Arizona from 1972-74 for coliform bacteria and fecal streptococci indicates that water in the reservoir is unsafe to drink, but generally safe for recreational use. But fecal material is present in the water, and contamination will increase with additional recreational activity in the future. Samples from nine main channel sites all contained total coliforms in excess of the drinking water standard of a monthly average of one per 100 ml of surface water. The samples also showed that only 6% of the observations exceeded the safety standard for body contact recreation of 50-3000/100ml. At the alternate criterion of 1000/100 ml, 20% of the observations exceeded the standard. Fecal coliforms, estimated on the basis of 20% of total coliforms, were above the 200/100 ml minimum level for safe body contact in 27% of the observations. Fecal streptococci were detected at six of the sites, and probable Salmonella contamination at four sites. During the summer of 1974 increased sampling was conducted. In June and July 84-96% of the counts exceeded 1000 total coliforms/100 ml, and 58-61% exceeded 3000/100 ml. Both standards indicated that many sites were unfit for human body contact. A linear regressin management model is presented for estimating safe and hazardous water regression management model is presented for estimating safe and hazardous water conditions. (Lynch-Wisconsin)
W78-05972

EUTROPHICATION IN VERMONT,
Vermont Dept. of Water Resources, Montpelier. Water Quality Div.
For primary bibliographic entry see Field 5C.
W78-05977

APPROACHES TO THE STUDY OF MICROBIAL TRANSFORMATIONS OF METALS,
National Bureau of Standards, Washington, DC.
F. E. Brinckman, W. P. Iverson, and W. Blair.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 527, Price codes: A02 in paper copy, A01 in microfiche. In: Proceedings of the 3rd International Biodegradation Symposium, Kingston, RI, Aug 17-23, 1975, p 919-936, 1976. 14 fig, 3 tab, 27 ref. Final rept. to ONR, Wash., D.C. and NSRDL, Annapolis, Md. 3130118.

Descriptors: *Heavy metals, *Trace elements, *Speciation, *Spectrophotometry, *Water pollution effects, *Microbial transformation, Volatility, Graphite furnaces, Mercury, Microorganisms, Toxicity, Toxins, Pollutant identification, Food chains, Bioaccumulation, Methylmercury.

General approaches to the study of microbial transformations of trace metals are surveyed, and a research method is described based primarily on the detection and speciation of volatile forms of these metals. Simple quantitative means for surveying the potential of microorganisms for volatilizing metals are described. Transport agents were identified principally through use of flameless atomic spectrophotometry coupled with gas chromatography, which permits characterization of volatile metals and organometallic compounds in the nanogram range so that transformation at environmental levels may be monitored. Abiotic transfer of methyl groups from biologically methylated metals to mercury (II) is useful for speciation of volatile metal forms suspected of being methylated. Bacteria, fungi, algae, and protozoa all transform minerals, but certain groups contribute more than others to the geological distribution of mineral matter. Gradually increasing amounts of heavy metals from anthropogenic sources have been discharged to the aquatic environment, and food chain cycling in the vicinity of locally heavy concentrations have produced such disastrous effects as methylmercury poisoning at Minimata and Niigata, Japan. (Lynch-Wisconsin)
W78-05978

UTAH LAKE-JORDAN RIVER BASIN MODELING PROJECT. VOLUME I. SUMMARY REPORT. VOLUME II. APPENDIX.
Environmental Dynamics Inc., Los Angeles, CA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 609, Price codes: A05 in paper copy, A01 in microfiche and PB-255 575, A05 in paper copy, A01 in microfiche. Two technical reports prepared for EPA, Washington, D.C., Office of Water Quality. (Vol I Summary Rept): Oct 1973. 48 p, 23 fig, 1 tab; (Vol II App): June 1975. 87 p, 4 fig, 17 tab. EPA-68-01-0775.

Descriptors: *Utah Lake(UT), *Jordan River(UT), *Mathematical models, *Simulation analysis, *QUAL model, *Deep Reservoir Model, *Waste assimilative capacity, River basins, Basins, Lakes, Rivers, *Utah, Planning, Analytical techniques, Reservoirs, Computer programs, Deer Creek Reservoir(UT), Water management(Applied).

Expanded versions of the stream simulation model, QUAL, and the Deep Reservoir Model were applied to the Utah Lake-Jordan River Basin in Utah to study waste assimilation capacity for planning purposes and to verify the models. Limited routing capabilities of the original models, ranging from streamflow and water temperature only, to these plus dissolved oxygen, basic oxygen demand (BOD), and conservative minerals, were amplified to route a wide range of water quality indexes. All programming was done in FORTRAN IV. A one-dimensional mass balance analysis was used to route constituents in the new models, called QUAL II and Modified Deep Reservoir Model. For application of QUAL II, the flow regimes of the Utah Lake-Jordan River Basin were segmented into seven subsystems. While flow records were excellent, water quality data for tributaries were seriously deficient; simulation results must therefore be interpreted with caution. Simulated parameters for the Upper Provo River subsystem coinciding directly with historical data included dissolved oxygen, hex-valent chromium, boron, TDS, nitrite, nitrate, phosphorus, and ambient coliforms. The BOD profile was very similar, while ammonia and temperature varied somewhat in some reaches. Other subsystems displayed comparable results, with the exception of Utah Lake, the simulation of which proved inaccurate. The Modified Deep Reservoir Model was applied to Deer Creek Reservoir, but historical data was severely limited. (Lynch-Wisconsin)
W78-05983

PROCEDURES FOR ESTIMATING DRY WEATHER POLLUTANT DEPOSITION IN SEWERAGE SYSTEMS,
Energy and Environmental Analysis, Inc., Boston, MA.
W. C. Pisano, and C. S. Queiroz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 695, Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA-600/2-77-120, July, 1977. 92 p, 18 fig, 22 tab, 11 ref, 3 append. R804579.

Descriptors: *Combined sewers, *Mathematical models, *Regression analysis, *Water pollution, *Forecasting, Water quality, Economics, Maintenance, On-site investigations, Measurement, Pollutant identification, Waste water treatment, *Flushing, *Dry weather sewage bed, Field measurements.

A set of generalized procedures for estimating pollutant loadings associated with dry weather sewage solids deposition in combined sewer systems as presented. The predictive equations relate the total daily mass of pollutant deposition accumulations within a collection system to physical characteristics of collections systems (e.g., per capita waste rate, service area, total pipe length, average pipe slope, average diameter, etc.) A complex distributed-parameter dry weather sewage deposition model was applied to 75 separate and combined sewer collection systems in eastern Massachusetts to generate estimates of solids deposited in the systems (lb/day). These estimated loads were then regressed with selected variables representing the physical characteristics of the collection resulting in 4 predictive single term power functions with at most 4 independent variables. A high degree of fit of the nonlinear functions to the data set was achieved, with the R2 values ranging from 0.85 to 0.95. Several alternative predictive models which reflect anticipated differences in the availability of data and user resources are presented. Pollutant parameters include suspended solids, volatile suspended solids, biochemical oxygen demand, chemical oxygen demand, total organic nitrogen, and total phosphorus. Sewer system age and degree of maintenance were considered. Factors are presented for estimating the increase in collection system deposition resulting from improper maintenance. A user's guide is included. (Seip-IPA)
W78-05984

EFFECT OF LAND DISPOSAL APPLICATIONS OF MUNICIPAL WASTES ON CROP YIELDS AND HEAVY METAL UPTAKE,
National Fertilizer Development Center, Muscle Shoals, AL.
P. M. Giordano, and D. A. Mays.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 649, Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA - 600/2-77-014, April, 1977. 73 p, 2 fig, 35 tab, 19 ref. append. EPA-IAG-D4-0415.

Descriptors: *Rates of application, *Heavy metals, *Absorption, *Soil treatment, *Fertilizers, Sewage disposal, Sludge disposal, Municipal wastes, Leaching, Movement, *Heavy metal uptake, *Heavy metal movement, *Land application.

Heavy metal uptake in soils and plants resulting from land application of municipal compost and sewage sludge was investigated over a 7-year period. Special emphasis was placed on uptake and cumulative and residual availability of Cd, Zn, Ni, Pb, and Cu to vegetable crops grown in the field. Multiple applications of composted garbage refuse totaling 900 metric tons/hectare have resulted in satisfactory crop growth with only a moderate increase of some heavy metals in plant tissues. In contrast, lower application rates of several domestic sewages resulted in significant uptake of certain metals, especially in more sensitive species such as leafy vegetables and string beans. Although heavy metals accumulate with repeated treatment, plant abailability seems to be related to product matrix rather than to total content. Uptake rates from inorganic and organic sources were compared. Heavy metal movement in soil profiles from municipal waste applications were investigated under simulated and natural rainfall conditions. Mobility of heavy metals is slightly greater from inorganic than from organic sources but is minimal under even severe leaching situations; groundwater contamination from heavy application is unlikely except in very acid soils where mobility would be greater. The economic return of municipal waste application, when compared to chemical fertilizer application, is minimal. (Seip-IPA)
W78-05985

ENVIRONMENTAL INFLUENCES ON THE ACCUMULATION OF LEAD, CADMIUM, MERCURY, ANTIMONY, ARSENIC, SELENIUM, BROMINE AND TIN IN UNICELLULAR ALGAE CULTIVATED IN THAILAND AND IN GERMANY,
Gesellschaft fuer Strahlen- und Unweltforschung m.b.H., Neuherbergbei Munich (West Germany).
For primary bibliographic entry see Field 5C.
W78-05998

NITROGEN - AN ESSENTIAL LIFE FACTOR AND A GROWING ENVIRONMENTAL HAZARD, REPORT FROM NOBEL SYMPOSIUM NO. 38.
AMBIO, Vol. 6, No. 2-3, p 96-105, 1977. 4 fig, 48 ref. Edited by B. Bolin and E. Arrhenius.

Descriptors: *Nitrogen, *Hazards, *Environmental effects, Nitrates, Nitrites, Ammonium compounds, Nitrogen compounds, Nitrogen cycle, Nitrogen fixation, Runoff, Leaching, Oxidation-reduction potential, Agricultural runoff, Toxicity, Economics, Eutrophication.

A review of the basic relationships of nitrogen to the life cycle shows that it is one of the elements essential for building cells of which all living organisms are composed. It occurs in food, in natural products, in the products of ammonia based industry, in soil, in bodies of water and in the atmosphere. The relative amounts of nitrogen in the various global compartments vary widely but are found in ratios of approximately 1:30:30:600 for microorganisms:plant biomass:soil inorganic nitrogen:soil organic matter. In a mature terrestrial ecosystem the nitrogen cycle is balanced and almost closed. The main processes whereby nitrogen enters this system are biological nitrogen fixation and deposition from the atmosphere. The processes by which nitrogen leaves the system are: leaching, denitrification, erosion, surface runoff and ammonia volatization. Human activities that interfere most with the nitrogen cycle are agriculture, combustion and waste treatment. The main effects obtained are contamination of water bodies with nitrogen compounds leading to eutrophication and health hazards, pollution of air, acidification of soil and water, and diminishing of the stratospheric ozone. Some of the measures that would alleviate the undesirable effects of human intervention in the nitrogen cycle include: increased use of solar, water and wind energy; promotion of local energy production units; development of more efficient combustion engines; promotion of public transport; development of small scale waste-recycling units; and development of the waste disposal system that does not use water as vehicle. (Harris-Wisconsin)
W78-05999

ALKALINE POTASSIUM PERMANGANATE DEGRADATION OF INSOLUBLE ORGANIC RESIDUES (KEROGEN) ISOLATED FROM RECENTLY-DEPOSITED ALGAL MATS,
California Univ., Berkeley. Dept. of Chemistry.
R. P. Philp, and E. Yang.
Energy Sources, Vol. 3, No. 2, p 149-161, 1977. 4 fig, 2 tab, 13 ref. NASA NGL-05-003-003.

Descriptors: *Degradation(Decomposition), *Potassium permanganate, *Algal mats, *Kerogens, *Organic compounds, Oil shales, Algae, Cyanophyta, Oxidation, Methodology, Analytical techniques, Microcoleus chthonoplastes, Lyngbya aestuarii, *Laguna Mormona(Mexico), Extraction.

Although kerogen is the most abundant form of organic carbon and is very important in hydrocarbon formation, relatively little is known of its origin, formation, or structure. In this study, insoluble organic matter was isolated from an algal mat from Laguna Mormona, Baja California (Mexico), and the kerogen-like residue extracted and then degraded by stepwise alkaline potassium permanganate oxidation. The findings support the theory that kerogen-like precursors are present in recently-deposited algal mats, and it is proposed that with increasing time additional lipid materials can become bound to this residue. Cross-linking and defunctionalization may also occur, finally producing the algal type of kerogens found in many ancient oil shales and sediments. The algal mat used in the experiments was formed primarily by the filamentous cyanophytes Microcoleus chthonoplastes and Lyngbya aestuarii. The mat was digested with 6N HCl and 48% HF to remove carbonates and silicates. The residue was extracted over two weeks, and divided into two portions; one portion was saponified. Major oxidation products from the subsequent degradation included alpha, omega-dicarboxylic acids, normal mono-carboxylic acids, isoprenoid acids, and mono-methyl branched acids. Problems involved with destructive degradation techniques for structural determination of kerogen are discussed. (Lynch-Wisconsin)
W78-06000

A METHOD OF MEASURING AIRBORNE ACIDITY: ITS APPLICATION FOR THE DETERMINING OF ACID CONTENT ON LONG-DISTANCE TRANSPORTED PARTICLES AND IN DRAINAGE WATER FROM SPRUCES,
Swedish Water and Air Pollution Research Lab., Goteborg.
For primary bibliographic entry see Field 5A.
W78-06003

NITROGEN CYCLES IN A POLLUTED SEA AREA,
Tokyo Univ. (Japan). Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5C.
W78-06004

UPTAKE OF DISSOLVED AMMONIUM AND NITRATE ION BY THE FRY OF COMMON CARP, CRUCIAN CARP AND LOACH FROM SURROUNDING WATER, (IN JAPANESE),
Freshwater Fisheries Research Lab., Tokyo (Japan).
For primary bibliographic entry see Field 5C.
W78-06006

THE EFFECT OF CHEMICAL SUBSTANCES AND THEIR COMBINATIONS ON WATER MICROFLORA, (IN RUSSIAN),
Institute of General and Municipal Hygiene, Moscow (USSR).
For primary bibliographic entry see Field 5C.
W78-06014

NITRIFICATION IN RUNNING WATERS: CASE STUDY GLATT, (IN GERMAN),
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
W. Gujer.
Schweiz Z Hydrol 38(2), p 171-190, 1976.

Descriptors: *Nitrification, Rivers, Model studies, Path of pollutants, Waste water treatment, *Ammonium, *Switzerland, Water pollution control.

Todays ammonium concentrations in large Swiss rivers are well within the admissible tolerance threshold, but smaller rivers flowing through densely populated areas are likely to be overloaded with ammonium. A proposed nitrification model for rivers permits an evaluation of the influence of water pollution control measures on the ammonium load in the rivers. On the basis of a cast study, the use of this nitrification model for the Glatt river is discussed. Mean annual values are insufficient for planning water pollution control measures, different values based on seasonal variations are necessary. Nitrification in Swiss rivers is low when compared to possible ammonium inputs. At a mean time of flow of 24 h, the Glatt river nitrifies only about 40% of its ammonium input. If wastewater cannot be sufficiently diluted, it has to be nitrified in wastewater treatment plants. Lakes generally decouple ammonium loadings present in the inlet and in the outlet.--Copyright 1978, Biological Abstracts, Inc.
W78-06015

INVESTIGATION OF THE SUSPENDED SOLIDS FROM LAKE CONSTANCE AFFLUENTS, (IN GERMAN),
Staatliches Inst. fuer Seenforschung und Seenbewirtschaftung, Langenargen (West Germany).
G. Wagner.
Schweiz Z Hydrol 38(2), p 191-206, 1976.

Descriptors: *Suspended solids, *Lake Constance(Switz), Lakes, *Path of pollutants, *Phosphates, Switzerland, Water pollution sources.

From 1970-1973 suspended solids taken out of the most important effluents of Lake Constance (Switzerland) were isolated during different water discharges in the rivers. The concentrations of some elements within the dried substances were determined. The concentrations of C, N, P, Ni, Cr, Cd and Zn proved to be strongly influenced by civilization, on the other hand those of Co, Fe and Mn only a little or not. The suspended matter from the Bregenzer Ach and the Neuer Rhein was hardly polluted and that from the Schussen most

polluted by elements coming from local waste waters. The loads in every river were calculated by the relations between water discharge, concentration of suspended solids and concentration of the elements within the substance. THe greatest loads were transported by the largest rivers. Maximum loads were noticed during high water periods. Results of tests with material not being dried, mixed in hypolimnic waters of Lake Constance, showed that only the material from the Bregenzer Ach and the Neuer Rhein adsorp phosphate out of the water. These substances participated in the transport of originally soluted phosphate. The suspended solids of all the other rivers gave phosphate to the water.--Copyright 1978, Biological Abstracts, Inc.
W78-06016

LONG RANGE TRANSPORT OF AIR POLLUTANTS IN EUROPE AND ACID PRECIPITATION IN NORWAY,
Norwegian Meteorological Inst., Oslo; and Norsk Inst. for Luftforskning, Kjeller.
For primary bibliographic entry see Field 5A.
W78-06018

MIGRATION OF TRACE METALS IN INTERFACES OF SEAWATER AND POLLUTED SURFICIAL SEDIMENTS,
University of Southern California, Los Angeles. Environmental Engineering Program.
J. C. S. Lu, and K. Y. Chen.
Environmental Science and Technology, Vol. 11, No. 2, p 174-182, February 1977. 9 fig, 3 tab, 45 ref.

Descriptors: *Sediment-water interfaces, *Migration, *Trace elements, *Metals, *Path of pollutants, *Oxidation-reduction potential, Sediments, Water pollution, Pollutants, Model studies, Interstices, Los Angeles harbor(CA), California.

A study of the migration of trace metals between water and sediments on three typically-polluted nearshore surficial sediments (clay, sand, and silt) from Los Angeles harbor, California, showed that the direction of migration was regulated by oxidation-reduction condition rather than by sediment type. Three general trends involving different trace metals were observed and confirmed with an equilibrium model: (1) the released amount increased as the oxidation-reduction condition became progressively reducing (iron and manganese); (2) the released amount increased as the environment became more oxidizing (cadmium, copper, nickel, lead, and zinc); and (3) there was no significant change of concentration in interfacial water (mercury and chromium). In general, trace metal concentrations in interfacial water were in the sub-ppb range. Possible mechanisms for migration are chemical transformation, bio-oxidation, sorption, dissolution, precipitation, complexation, and diffusion. The first four probably take place at the sediment particle surface and finally form the solubility-controlling solids of trace metals, while the last three probably occur in the bulk solution, and can further regulate the concentration levels and speciation of the trace metals in the interfacial waters. Despite the complexity of the metal chemistry in the sediment-water interface, the behavior of metal species can be reasonably well-predicted if environmental conditions are known. (Lynch-Wisconsin)
W78-06022

A SEARCH FOR CYTOPATHOGENIC VIRUSES IN SURFACE AND COASTAL SEA WATER IN THE PROVINCE OF PISA (ITALY), (IN ITALIAN),
Pisa Univ. (Italy). Ist. di Igine.
A. Ruschi, and D. Matteucci.
Riv Ital Ig 35(4-6), p 103-109, 1975.

Descriptors: *Cytopathogenic viruses, *Bacteria, *Viruses, Sea water, *Pisa(Italy), Adenovirus, Arno River(Italy), Coxsackievirus, Echovirus, Morto River(Italy), Picornaviruses, Poliovirus, Rivers, Serchio River(Italy).

River and sea waters of Pisa Province were examined for cytopathogenic viruses using various cell lines and primary cultures. The percentages of positive samples were: 26% from the Serchio river, 46% from Morto river, 60% from Arno river and 65% of sea-water samples taken near a sewage outlet. The viruses isolated were coxsackie B, echo, adeno, polio and coxsackie A. All polioviruses isolated were of vaccine origin.--Copyright 1978, Biological Abstracts, Inc.
W78-06023

HYDROGEN ION SPECIATION IN THE ACID PRECIPITATION OF THE NORTHEASTERN UNITED STATES,
Cornell Univ., Ithaca, NY. Section of Ecology and Systematics.
For primary bibliographic entry see Field 5A.
W78-06025

THE CHEMICAL COMPOSITION OF ATMOSPHERIC PRECIPITATION FROM SELECTED STATIONS IN MICHIGAN,
Michigan Univ., Ann Arbor. School of Natural Resources.
For primary bibliographic entry see Field 5A.
W78-06027

EFFECT ON GROUNDWATER OF INFILTRATION AND WASTE WATER TREATMENT NEAR ANN, JAMTLAND COUNTY, (IN SWEDISH),
Chalmers Univ. of Technology, Goteborg (Sweden). Vatten Inst. Tek.
L. Carlsson.
Vatten 33(2), p 144-152, 1977.

Descriptors: *Infiltration, *Groundwater, Waste water treatment, Pre-treatment(Water), Sampling, Tracers, Ammonia, Carbonates, Chlorides, Hydrocarbonates, Oxygen, Permeability, Soils, *Sweden, Nitrates.

Pre-treated wastewater has since Jan. 1973 been infiltrated in glacifluvial sand and gravel in the neighborhood of the village of Ann in the county of Jamtland (Sweden). The amount of infiltration is 130-140 m3/day. The influence on the groundwater was observed by water samples taken from 10 observation tubes surrounding the open infiltration pond. An increase in the conductivity of the groundwater was noticed together with increases in ammonia, hydrocarbonate and chloride. At first an increase was also observed in the nitrate content but later a decrease in both Oz and nitrate occurred. By tracer experiment the percolation velocity was determined together with the permeability of the soil.--Copyright 1978, Biological Abstracts, Inc.
W78-06028

THE BIOGENIC CARBON BALANCE IN A GROUND WATER INFILTRATION ENRICHMENT SYSTEM, (IN RUSSIAN),
Academy of Municipal Economy, Moscow (USSR). Research Inst. of Public Water Supply, Water Purification.
S. N. Chekalova.
Gig Sanit 2, p 103-104, 1977.

Descriptors: Cyanophyta, Chlorophyta, Organic wastes, Groundwater, Phytoplankton, Infiltration, Water pollution control, Carbon balance, Algae, Diatoms, USSR.

The possible pollution of ground water with organic substances resulting from the drying off of phytoplankton (blue-green algae, diatoms, green algae) in a infiltration enrichment basin was studied in the Baltezers water supply basin, fed by Lake Baltezers (Riga (USSR)). Noticeable concentrations of C do not evidently pollute the ground water in this system, but ground water enrichment from a body of water during a bloom should be avoided.--Copyright 1978, Biological Absrtracts, Inc.
W78-06030

ORGANIC MATTER DISTRIBUTION CHARACTERISTICS IN THE SHOAL SEDIMENTS OF THE SELENGA DELTA IN LAKE BAIKAL, (IN RUSSIAN),
Limnologicheskii Inst., Irkutsk (USSR).
L. A. Vykhristyuk, and F. I. Lazo.
Izv Sib Otd Akad Nauk SSSR Ser Biol Nauk 2, p 40-47, 1976.

Descriptors: *Organic matter, Distribution, Path of pollutants, Sediments, *Deltas, Sediment transport, Humic acids, *Bottom sediments, Lake Baikal(USSR), Biochemistry, Pigments, Selenga Delta(USSR).

New data about qualitative components of organic matter (OB) (humic acids, vegetable pigments and components of OB which are hydrolyzed lightly) are presented. The peculiarities of OB distributions in the bottom sediments of the Selenga shoal (Siberian SSR, USSR) are considered.--Copyright 1978, Biological Abstracts, Inc.
W78-06034

BACTERIAL WATER QUALITY IN WILDERNESS AREAS,
California Univ., Davis. Dept. of Engineering; and California Univ., Davis. Dept. of Environmental Science.
R. P. Ghirelli, and L. Marler.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 690, Price codes: A04 in paper copy, A01 in microfiche. Contribution No. 162, California Water Resources Center, June, 1977. 50 p, 21 fig, 43 ref. (Project UCAL-WRC-W-489).

Descriptors: *Bacteria, *Water pollution, Water quality, *California, Distribution, Watersheds(Basins), Sampling, Bioindicators, Path of pollutants, Bishop Creek(Calif), Rock Creek(Calif), *Yersinia entercolitica.

The objective of this study was to elucidate incidence and distribution of Yersinia enterocolitica in the Bishop Creek and Rock Creek Watersheds of the eastern Sierra. An intensive sampling program covering water from many locations, small mammals and soil was conducted. A second objective was to test hypotheses regarding origin of the bacterium. Results are that routinely used indicator organisms do not protect against exposure to Y. enterocolitica. The data are consistent, but in no sense conclusive, with fecal contamination by small mammals as a source. Procedures are needed both to isolate and to quantify Y. enterocolitica from source samples. (Snyder-Calif, Davis)
W78-06038

BIOSTIMULATION CHARACTERISTICS OF WASTES AND RECEIVING WATERS OF THE SNAKE RIVER BASIN.
National Field Investigations Center-Denver, CO.
For primary bibliographic entry see Field 5C.
W78-06045

THE QUALITY OF LAKE OF THE OZARKS.
Environmental Protection Agency, Region VII, Kansas, MO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 667, Price codes: A03 in paper copy, A01 in microfiche. June, 1972. 36 p, 6 fig, 9 tab, 6 ref, 1 append.

Descriptors: *Lake of the Ozarks(MO), *Water quality, *Regional development, *Recreation, *Water pollution sources, *Water pollution effects, *Missouri, Lakes, Waste treatment, Treatment facilities, Tributaries, Bacteria, Coliforms, Impoundments, Mesotrophy, Nutrients.

Monthly sampling of water quality at 21 stations in Lake of the Ozarks, Missouri between September 1970-October 1971 indicates that lake water quality is generally good and in most areas is suitable for all recreational uses. Certain problems exist, however: (1) Lack of planned development along the shoreline poses a threat to water quality. (2) Certain tributaries carry large amounts of iron-rich particulate matter from coal strip mine areas. (3) Periods of intense rainfall increase bacteria load discharged by tributaries due to land runoff. (4) Turbidity decreases downstream. (5) Drainage from septic tank leach fields was not readily apparent. (6) Significant fecal coliform densities were monitored at one station and several tributaries during limit established by the state for body contact recreation. (7) Only slight coliform increases occurred during the heavy use period. (8) No nuisance rooted plant or phytoplankton growths were observed. (9) Primary productivity studies indicated mesotrophic conditions. (10) During May and July carbon fixation rates appeared limited by lack of soluble phosphorus. (11) Major nutrient sources are tributaries, spetic tank leachates, boat wastes, and discharges from municipal and resort sewage treatment facilities. Lake of the Ozarks was created by Bagnell Dam, begun in 1929. During the summer population grows from the normal 25-30,000 to about 100,000. (Lynch-Wisconsin)
W78-06050

NATURE AND TREATABILITY OF DYEING WASTEWATERS,
Hawaii Univ. at Manoa. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5D.
W78-06080

POLLUTION INDICATORS AND OTHER MICROORGANISMS IN RIVER SEDIMENT,
Connecticut Univ., Storrs. Biological Sciences Group.
For primary bibliographic entry see Field 5A.
W78-06096

DISPERSION CALCULATIONS IN NONUNIFORM SEEPAGE,
Canterbury Univ., Christchurch (New Zealand). Dept. of Civil Engineering.
B. Hunt.
Journal of Hydrology, Vol 36, No 3/4, p 261-277, February 1978. 11 fig, 20 ref, 1 append.

Descriptors: *Dispersion, *Groundwater movement, *Model studies, Mathematical models, Aquifers, Groundwater, Soil contamination, Pollutants, *Path of pollutants, Non-uniform flow, Permeability, Infiltration, Seepage, Hydrology.

A singular perturbation approximation was derived and applied to some examples in groundwater dispersion. This approximation is general enough to be used for nonuniform steady and unsteady seepage through heterogeneous aquifers. The approximation complements numerical methods since it becomes most accurate in regions where accurate numerical solutions are almost accurate in regions where accurate numerical solutions are almost impossible to obtain. (Sims-ISWS)
W78-06099

UPTAKE BY BARLEY OF WATER TABLE- OR SURFACE-APPLIED CADMIUM,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
M. B. Kirkham.
Soil Science Society of America Journal, Vol 41, No 6, p 1125-1129, November-December 1977. 3 fig, 3 tab, 19 ref.

Descriptors: *Cadmium, *Absorption, *Barley, Laboratory tests, Soil contamination, *Plant physiology, Water pollution, Pollutants, Path of pollutants, Groundwater, Leaching, Leachate, Effluents, Drainage, Water table, Soil science, Cadmium uptake.

Solution of Cd were placed for 66 days at the bottom or top of columns (42-cm long by 15-cm diam) containing fine sandy loam soil, half of which were planted with barley and half of which were bare, to determine rate of movement upward or downward of Cd. Three solutions with Cd, as CdSO4, were used: distilled water with 0.1 microgram/ml Cd; distilled water with 10 microgram/ml Cd; secondary effluent with 10 microgram/ml Cd. An average of 200 ml/day was added to the top or bottom of columns with plants; there was not drainage water with top additions. An average of 100 or 50 ml/day was added to the top or bottom, respectively, of columns without plants. Drainage water, which collected at the bottom of columns without plants and watered from the top, was analyzed daily for Cd. Plants and soil were analyzed weekly for Cd concentation. In less than 7 days, Cd applied at the surface moved to the bottom moved to the surface. Cd than plants treated with Cd at the top because roots of plants with Cd at the Cd at the top. Columns without roots had higher concentrations of extractable Cd than columns with roots. Concentrations of Cd in leachate from columns receiving 10 microgram Cd/ml effluent were about two times higher than concentrations of Cd in leachate from columns recieving 10 microgram Cd/ml water. The results showed that barley roots more readily absorbed Cd placed in a shallow water table than Cd placed in the soil surface. (Sims-ISWS)
W78-06111

SEASONAL TRENDS OF NH4(+) AND NO3(-) NITROGEN ISOTOPE COMPOSITION IN RAIN COLLECTED AT JULICH, GERMANY,
Kerntorschungsanlage Juelich G.m.b.H. (West Germany). Inst. fuer Chemie.
For primary bibliographic entry see Field 5A.
W78-06113

COMPARATIVE CHEMISTRY OF A COOLING RESERVOIR AND ITS WATER SOURCE,
North Texas State Univ., Denton. Dept. of Biological Science.
B. L. Sams, J. K. Silvey, and J. A. Stanford.
Journal of the Water Pollution Control Federation, Vol 50, No 2, p 193-202, February 1978. 9 fig, 4 tab, 42 ref. EPA T-900115.

Descriptors: *Reservoirs, *Water chemistry, *Benthos, *Water quality, *Cooling water, Aquatic life, Biota, Industrial water, Nutrients, Chemical analysis, Nutrient removal, Analytical techniques, Phosphates, Sedimentation, Aquatic production, Water pollution sources, Phosphorus compounds, *Texas, Limnology, *North Lake Reservoir(Tex).

To better understand limnological processes in southern reservoirs receiving heated effluents, water was analyzed before and after impoundment in 330-ha North Lake. Macronutrients and metals were quantified within the water column and in the sediments during this 2-year study. Reservoir source water from Elm Fork, Trinity River contained 16 times more total phosphorus and supported 23 times more Selenastrum capricornutum cells in an algal assay than did water from the impoundment. The reservoir has essentially no drainage, and since evaporation is high, the concentrations of many dissolved solids have increased three-to sevenfold since the reservoir was first filled in 1958. North Lake is presently phosphorus-limited, based on algal assay and chemical data. Apparently altered chemical equilibria have caused adsorption of precipitation of phosphorus with calcium and iron. (Henley-ISWS)
W78-06114

BACTERIAL VARIATIONS IN STREAMS FROM A SOUTHWEST IDAHO RANGELAND WATERSHED,
Agricultural Research Service, Boise, ID. Northwest Watershed Research Center.
G. R. Stephenson, and L. V. Street.
Journal of Environmental Quality, Vol. 7, No 1, p 150-157, January-March 1978. 5 fig, 1 tab, 29 ref.

Descriptors: *Coliforms, Water pollution, *Farm wastes, *Idaho, *Range management, *Water pollution sources, Bacteria, Analytical techniques, Bioindicators, Pasture management, Pollutant identification, Pollutants, Water quality, Agricultural runoff, Livestock, Storm runoff, Investigations.

Sources and variations in bacterial indicators were reported from stream sites over a 3-year period on a 233-sq km rangeland watershed in southwest Idaho. The occurrence of fecal coliforms was related directly to the presence of cattle on summer range and winter pastures. Fecal coliforms counts in adjacent streams were found to increase soon after cattle were turned in and remained high for several months after cattle were removed. Runoff from rainstorms increased both total and fecal coliform concentrations in streams on summer range with limited management and adjacent to winter pastures, but runoff from snowmelt had little effect. Total coliform counts varied more with change in streamflow than did fecal coliform counts. In fenced summer range allotments, under deferred grazing management, the effects were the same, except bacterial counts were not as high or persistent. The decrease in bacterial concentrations at several downstream sampling sites indicated that certain stream segments were self-purifying. The presence or absence of livestock along the streams overshadow any effect variations in chemical concentration of the water might have on bacterial concentrations. (Henley-ISWS)
W78-06116

EVALUATION OF LEACHATE CHARACTERISTICS AND PHYSICAL PROPERTIES OF COMPACTED MIXTURES OF FLY ASH AND WASTEWATER SLUDGE,
West Virginia Univ., Morgantown.
R. B. Helm.
Available from University Microfilms International, Ann Arbor, Michigan 48106; Order No. 77-22, 453. PhD Thesis, 1976, 224 p.

Descriptors: *Leachate, *Waste disposal, *Municipal wastes, *Water analysis, *Trace elements, Biodegradation, Analytical techniques, Leaching, Industrial wastes, Path of pollutants, Soil chemistry, Waste water disposal.

Laboratory investigations were used to assess the environmental impact of combined disposal of municipal waste water sludge and power plant fly ash as structural fill or in highway embankments. Various combinations of two municipal sludges and four different ashes were tested. Leachate characteristics, the extent of biological degradation of sludge organic matter, permeability, unconfined compressive strength, and the effects of calcium sulfate and lime as additives were examined. Analyses of the leachate samples measured pH, total dissolved solids, boron, copper, iron, manganese, nickel, lead, and zinc. Total organic carbon, sulfate, calcium, and magnesium were measured in selected samples. Leach pH ranged from 7.0 to 12.4; total dissolved solids from 400 to 3,800 ppm, and total organic carbon from 1 to 770 ppm. Trace elements which were suggested as posing a potential environmental hazard included boron and copper. Lime addition was capable of reduc-

ing the boron concentration to below 1 ppm and increasing the compressive strength up to 40 psi. No significant biological decomposition of organics was observed. Various statistical techniques were used in the data reduction. (Schulz-FIRL)
W78-06118

REVIEW AND APPRAISAL OF NUMERICAL CIRCULATION MODELS FOR LAKE MICHIGAN,
Argonne National Lab., IL. Energy and Environmental Systems Div.
For primary bibliographic entry see Field 2H.
W78-06122

EROSION AND SEDIMENT CONTROL. SURFACE MINING IN THE EASTERN U.S. VOLUME I. PLANNING. VOLUME II. DESIGN,
Hittman Associates, Inc., Columbia, MD.
For primary bibliographic entry see Field 5G.
W78-06127

THE EFFECT OF THE SPRAY IRRIGATION OF SECONDARY TREATED EFFLUENT ON THE VEGETATION, SOILS AND GROUNDWATER QUALITY IN A NEW JERSEY PINE BARRENS HABITAT,
Rutgers - The State Univ., New Brunswick, NJ.
G. S. Sawhill.
Available from University Microfilms International, Ann Arbor, Michigan 48106; Order No 77-25, 015. PhD Thesis, 1977, 194 p.

Descriptors: *Soil-water-plant relationships, *Groundwater, *Sprinkler irrigation, *Waste water disposal, *Soil water, Groundwater recharge, Base flow, Waste assimilative capacity, On-site data collections, Nitrates, Water analysis, Environmental effects, Path of pollutants, Waste water treatment, *New Jersey.

The Stockton State College spray disposal system at Pomona, New Jersey, was the site of an investigation on the waste assimilative capacity of the sandy soils of the pine barrens region for secondary treated effluent. The study area is described as a pine-oak ecosystem, having a continental climate with prevailing land and sea breezes and acidic sandy soils. The site received monthly applications of secondary treated effluent at average rates 2.13 ha-cm/ha. Analyses of seasonal samples of groundwater and effluent revealed significant variability in chemical constituents. The electrical conductivity, pH, and the concentrations of Ca, Mg, K, NH4-N, NO3-N, Cl, and SO4 were significantly higher in groundwater collected at the spray irrigation site than in the control area, with NO3-N concentrations exceeding EPA limits for potable water. Perturbations in prevailing species as well as in of total N, crude protein, Ca, Mg, Na, K, P, and Cl were observed in both summer and winter vegetation. Although groundwater levels were not affected, increased base saturation due to Ca and Na was observed. (Schulz-FIRL)
W78-06135

CHEMICAL ASPECTS OF GROUND WATER RECHARGE WITH WASTEWATERS,
California Univ., Berkeley.
L. L. Russell.
Available from University Microfilms International, Ann Arbor, Michigan 48106; Order No. 77-15,842. PhD Thesis, 1976, 425 p.

Descriptors: *Artificial recharge, *Groundwater recharge, *Water management(Applied), *Aeration, Carbon dioxide, Waste water disposal, Soils, Soil chemistry, Soil contamination effects, Nitrification, Mathematical models, Waste water treatment, Waste water disposal.

Studies on waste water-soil systems and recharge water quality indicated that nitrification in the soil rather than in a waste water treatment plant could substantially reduce percolant water quality. This was attributed to low carbon dioxide concentrations in aerated effluents which could also dissolve calcareous soils, resulting in high calcium concentrations of up to 200 mg/liter. Field studies at the 14-mgd Whittier Narrows Water Reclamation Plant and the 26-mgd San Jose Creek Water Renovation Plant indicated that 90-95% of the CO2 produced during treatment was stripped during aeration. A systematic, mathematical model for the chemistry of a waste water-soil system is presented. The effects of minor buffering systems, complex ion formation, temperature, and ionic strength are incorporated into the model. The model is useful in simulating the effects of waste water treatment on effluent quality and the effects of land application on percolant quality, mixing, dilution, and subsequent chemical reactions during percolation. (Schulz-FIRL)
W78-06141

DISSOLVED ORGANIC MATTER AND LAKE METABOLISM,
Michigan State Univ., Hickory Corners. W. K. Kellogg Gull Lake Labs.
For primary bibliographic entry see Field 5C.
W78-06142

EFFECTS OF ANAEROBICALLY DIGESTED MUNICIPAL SEWAGE SLUDGE APPLICATION ON CHEMICAL PROPERTIES OF SELECTED SOILS WITH EMPHASIS ON DISTRIBUTION OF ZINC AND CADMIUM FORMS,
Cornell Univ., Ithaca, NY.
A. Koenig.
Available from University Microfilms International, Ann Arbor, Michigan 48106; Order No. 77-18,175. PhD Thesis, 1976, 369 p.

Descriptors: *Fertilizers, *Sludge disposal, *Zinc, *Cadmium, *Anaerobic digestion, Heavy metals, Soil chemical properties, Nitrification, Nitrogen, Phosphorus, Nutrient removal, Toxicity, Absorption, Waste water disposal.

Sixteen parallel experiments with a series of 10 batch reactors containing a mixture of dried anaerobically digested municipal sewage sludge and soil in specific proportions were used to investigate the effects of sewage sludge application on chemical properties of soils. The study evaluated the rate of extent of changes and degradation of sewage sludge; various zinc and cadmium forms in soil-sludge mixtures; nitrogen in soils; and zinc and cadmium in leachate with respect to temperature, water regime of soil-sludge mixtures, soil type, and sludge application rate. Zinc and cadmium in soluble, exchangeable, complexed, organic, and available forms were determined with an operational extraction scheme and sequential destructive analyses. The studies indicated that the transformation of metals in sludge-amended soils was most affected by organic matter degradation and nitrification which were, in turn, influenced by temperature, pH, moisture content, and organic matter content. Zinc and cadmium were not present in leachates, although nitrates and salts were apparent. (Schulz-FIRL)
W78-06173

DETERMINATION OF BIOCHEMICAL-OXYGEN-DEMAND PARAMETERS,
Geological Survey, Bay St. Louis, MS. Water Resources Div.; and Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5A.
W78-06174

HYDROLOGY AND WATER QUALITY OF THE ATCHAFALAYA RIVER BASIN,
Geological Survey, Baton Rouge, LA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W78-06184

BED CONDUCTION COMPUTATION FOR THERMAL MODELS,
Geological Survey, Bay St. Louis, MS. Water Resources Div.
For primary bibliographic entry see Field 8B.
W78-06185

SIMULATION OF WASTEWATER INJECTION INTO A COASTAL AQUIFER SYSTEM NEAR KAHULUI, MAUI, HAWAII,
Geological Survey, Reston, VA. Water Resources Div., and Geological Survey, Tallahassee, FL. Water Resources Div., and Geological Survey, Menlo Park, CA. Water Resources Div.
S. P. Larson, S. S. Papadopulos, H. H. Cooper, Jr., and W. L. Burnham.
In: ASCE Proceedings of Hydraulics in the Coastal Zone, College Station, Texas, August 10-12, 1977, p 107-116, 1977. 5 fig, 4 ref.

Descriptors: *Model studies, *Waste water disposal, *Injection wells, *Sewage effluents, *Hawaii, Coasts, Aquifers, Saline water-freshwater interfaces, Groundwater movement, Hydrogeology, Aquifer characteristics, Path of pollutants, Computer models, Analytical techniques, *Maui(Hawaii), Kahului County(Hawaii), Kahului Bay(Hawaii).

Evaluation of the Wailuku-Kahului Wastewater Treatment Facility, near Kahului, Maui, Hawaii, required study of the potential impact of injection of effluent into the saline-water part of a lava aquifer system. To determine the distribution of injected fluid, a computer model was constructed to enable consideration of (1) an aquifer system containing fresh and saline water, (2) heterogeneous aquifer characteristics, (3) nonuniform boundary conditions, and (4) concurrent withdrawal of saline water near the injection site. A sharp interface was assumed to exist between freshwater and saline water in the aquifer, and a numerical model was employed to simulate ground-water flow in the freshwater zone. Withdrawal of 68 cfs of saline water within 2,600 feet of the injection site was modeled analytically, and the numerical and analytical models were coupled to provide an acceptable prediction of aquifer response to injection. A simulated injection rate of 6.2 cfs resulted in a steady-stage wastewater plume extending 1,200 feet upgradient from the injection site and displacing the interface between freshwater and saline water 500 feet seaward. Three-dimensional analysis indicated that if fluid was injected into the saline-water zone and if vertical hydraulic conductivity were less than horizontal conductivity the injected plume of wastewater would be contracted in size at the top of the freshwater zone and expanded at the bottom relative to isotropic conditions. (Woodard-USGS)
W78-06186

WATER-QUALITY ASSESSMENT OF THE MIDDLE FORK ANDERSON RIVER WATERSHED, CRAWFORD AND PERRY COUNTIES, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
For primary bibliographic entry see Field 5A.
W78-06190

A WATER-QUALITY ASSESSMENT OF THE BUSSERON CREEK WATERSHED, SULLIVAN, VIGO, GREENE, AND CLAY COUNTIES, INDIANA,
Geological Survey, Indianapolis, IN. Water Resources Div.
S. E. Eikenberry.
Open-file report 78-13, January 1978. 36 p, 7 fig, 6 tab, 21 ref.

Descriptors: *Water quality, *Surface waters, *Mine drainage, *Municipal wastes, *Agricultural runoff, Indiana, Watersheds(Basins), Path of pollutants, Water analysis, Chemical analysis, Coal

mine wastes, Pesticides, Coliforms, Phytoplankton, Dissolved solids, Hydrogen ion concentration, Dissolved oxygen, *Busseron Creek watershed(Ind), Vigo County, Green County, Clay County.

Chemical quality of surface water in the 237-square mile Busseron Creek watershed, in Indiana, is significantly affected by drainage from coal mines and municipalities. Drainage from coal mines is primarily a problem of higher than normal dissolved-solids concentration, whereas, drainage from municipalities is generally a problem of bacteria and phytoplankton. Generally, the water is calcium bicarbonate type, except in streams affected by drainage from coal mines, where the water is a mixed calcium and magnesium sulfate type. Ranges of concentration (in milligrams per liter) of dissolved solids and of some of the chemical constituents dissolved in streams from September 1975 to July 1976 were: dissolved solids, from 104 to 2,610; iron, from 0.00 to 150; sulfate, from 14 to 1,900; chloride, from 3.3 to 130; nitrate (as nitroglen), from 0.01 to 5.3; phosphate (as phosphorus), from 0.1 to 1.7; and total organic carbon, from 2.4 to 60. Range of pH was from 2.7 to 9.6 Ranges of concentration of chlorinated hydrocarbons (in micrograms per kilogram) detected in bed material of streams were: aldrin, from 0.2 to 0.4; chlordane, from 0 to 13; DDE, from 0.0 to 0.3; dieldrin, from 0.0 to 9.8; and heptachlor epoxide, from 0 to 1.0. Streams draining municipalities had high populations of fecal coliform bacteria (as many as 46,000 colonies per 100 milliliter) and phytoplankton (as many as 190,000 cells per milliliter). Dissolved-oxygen concentration ranged from 2.8 to 15.0 milligrams per liter. (Woodard-USGS)
W78-06191

QUALITY OF RIVERS OF THE UNITED STATES, 1974 WATER YEAR--BASED ON THE NATIONAL STREAM QUALITY ACCOUNTING NETWORK (NASQAN),
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 5A.
W78-06192

5C. Effects Of Pollution

PRIMARY PLANKTON PRODUCTION IN LAKE BAIKAL, (IN RUSSIAN),
Akademiya Nauk SSSR, Leningrad. Zoologicheskii Inst.
V. V. Bul'on.
Zh Obshch Biol 37(4), p 517-524, 1976.

Descriptors: *Waste assimilative capacity, Chlorophyll, Lakes, Mesotrophy, *Oligotrophy, Photosynthesis, Plankton, *Primary productivity, *Lake Baikal(USSR), *Radiocarbon method, Water pollution effects.

The primary production of oligotrophic Lake Baikal (USSR) was determined Aug. 1975 using a modification of the radiocarbon method. For different areas, the daily primary production in the surface layer was 5.4-41.5 mg of C/m3 and 47-390 mg of C in the whole column of water/m2. The annual phytoplankton productivity calculated from the mean monthly values for the entire lake was 53 g of C/m2, or 558 kcal/m2. According to the chlorophyll a content, 0.5-6.5 mg/m3 (mean value 2.0 mg/m3), Lake Baikal approaches basins of the mesotrophic type. The photosynthetic activity of the phytoplankton expressed in daily assimilation values is 12.0 plus or minus 5.1 mg of C/mg of chlorophyll a. It is especially low (7.4) for the phytoplankton of the southern part of the lake. Copyright 1977 Biological Abstracts, Inc.
W78-05709

THE TOXICITY OF CARBOPHOS FOR SOME HYDROBIONTS, (IN RUSSIAN),
Azovskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Rostov-na-Donu (USSR).
V. A. Prokopenko, L. D. Zhiteneva, T. I. Sokol'skaya, V. P. Kalyuzhnaya, and L. N. Zavgorodnyaya.
Gidrobiol Zh 12(5), p 47-52, 1976.

Descriptors: Crustaceans, Carbohydrates, *Carbophos, Carp, Ceriodaphnia reticulata, *Hydrobionts, *Insecticides, Metabolism, Ponds, Protein, Simocephalus vetulus, *Toxicity, Systematics.

Carbophos (an insecticide) in concentrations of 0.001-0.5 mg/l has different effects on cladoceran Crustacea (Simocephalus vetulus, Ceriodaphnia reticulata) but eventually causes their death. Application of the preparation in the mentioned doses for preventative treatment of ponds will lead to annihilation of copepod-filtrates, the fodder objects for valuable commercial fish fry (carp). Action of 0.05-5.0 mg/l carbophos solutions on carp at the early stages of its development evokes, depending on the dose and exposition, greater or lesser pathological changes in morphology of blood, liver, kidney and spleen cells. Considerable disturbances in carbohydrate-protein metabolism were also found by biochemical methods. Application of the tested carbophos concentrations for the sanitary treatment of ponds is inexpedient. Copyright 1977 Biological Abstracts, Inc.
W78-05711

PLANNING METHODOLOGY FOR ANALYSIS AND MANAGEMENT ON LAKE EUTROPHICATION,
Yale Univ., New Haven, CT. School of Forestry and Environmental Studies.
A. P. O'Hayer, and J. F. Dowd.
Water Resources Bulletin, Vol 14, No 1, p 72-82, February 1978. 8 fig, 2 tab, 17 ref.

Descriptors: *Lakes, *Management, *Alternative planning, *Eutrophication, *Nutrient loading, *Bayesian decision analysis, *Uncertainty analysis, *Effects, Land use, Evaluation, Cost-effectiveness, Probability, Beseck Lake(Conn), Worth of data, Mathematical models, Systems analysis, Methodology, Water quality control.

The effects of changing nutrient inputs through land use management, wastewater treatment, or effluent diversion are unclear, and managers are finding that decisions effective in reversing eutrophication for one lake are often unsuccessful when applied to another. Simple empirical relationships are often used to predict the impact of management decisions. Errors in estimation could result either in substantial costs for overdesign or in failure to meet desired eutrophication levels. Presented is a methodology to analyze the impact of alternative land use and water resource management decisions on lake eutrophication; considered herein is the uncertainty in nutrient loadings. Monte Carlo simulation is used to estimate the probability of exceeding Vollenweider's critical loading for a particular set of land use conditions. An iterative scheme is designed, whereby additional alternatives or information can be considered until a satisfactory cost-effective solution appears. Bayesian decision analysis is shown effective for determining the worth of additional information. Problems of worth of additional data and uncertainty of estimates are handled within a cost-effectiveness framework. The probability of exceeding a critical level of eutrophication is considered as a measure of effectiveness. The cost criterion is the expected value of opportunity costs, costs of analysis, and costs of additional information. Uncertainty analysis techniques are used to estimate the effectiveness of various management alternatives. A cost-effectiveness analysis of several discrete land management alternatives for controlling eutrophication in Beseck Lake, Connecticut illustrates application of the methodology. (Bell-Cornell)
W78-05715

DYNAMICS OF THE BACTERIOPLANKTON POPULATION IN THE UCHINSKOYE RESERVOIR, (IN RUSSIAN),
Moscow State Univ. (USSR).
N. A. Potapova.
Gidrobiol Zh 12(5), p 66-68, 1976.

Descriptors: *Bacterioplankton, *Bacteria, *Plankton, Reservoirs, Russian-SFSR, Saprophytes, *Seasonal, *Uchinskoye Reservoir(USSR), *Vertical distribution, *Horizontal distribution.

A study was made in 1973 of the general population of bacteria, including saprophytes, their vertical and horizontal distribution and seasonal dynamics in the Uchinskoye reservoir (Russian SFSR, USSR), constructed in 1936-38. The general population of bacteria in the course of the vegetative season of 1973, in comparison with the 1st yr of the reservoir's existence (1937) was characterized by higher resistance and lower levels. The most favorable conditions for development of saprophytes occurred in the summer period. Their maximum quantity was observed in the northern section of the reservoir. The relation of the number of saprophytes to the general population of bacteria as a whole for the season characterizes the water body as being clean.--Copyright 1977, Biological Abstracts, Inc.
W78-05729

THE PRIMARY PRODUCTION OF PHYTOPLANKTON IN EXPERIMENTS ON BIOMONITORING AT THE UCHINSKOYE RESERVOIR, (IN RUSSIAN),
Moscow State Univ. (USSR). Dept. of Hydrobiolcgy.
D. V. Nakani, and M. N. Korsak.
Vestn Mosk Univ SER Vi Viol Pochvoved 31(3), p 74-77, 1976.

Descriptors: Carbon-14, *Monitoring, *Phytoplankton, *Primary, Productivity, Reservoirs, Russian-SFSR, *Uchinskoye Reservoir(USSR), Seasonal, Eutrophication, Chlorides, Nitrogen, Phosphorus, Manganese.

The object of this work was to forecast the behavior of planktonic community in 1978-1979. In the full factorial experiments 2 to the fourth power expected concentrations of N, P, Mn and Cl- in 1978-1979 were chosen as variables. Phytoplankton production was determined in situ by means of a flask method in a labeled C modification. If a trend of eutrophication in the Utchinskoye reservoir (Russian SFSR, USSR) remains, in the spring-summer season a slight increase of primary production will be observed. In summer-autumn the photosynthetic intensity will slightly decrease in connection with negative influence of salinity. However, because of eutrophication the phytoplankton production will not change significantly during the season.--Copyright 1977, Biological Abstracts, Inc.
W78-05733

PERACARIDA FROM LAKE DUSYA (BALTIC SEA BASIN) (IN RUSSIAN),
Akademiya Nauk Litovskoi SSR, Vinius. Inst. Zoologii i Parazitologii.
I. I. Gasyunas.
Gidrobiol Zh 11(1), p 46-50, 1976.

Descriptors: *Baltic Sea basin, Eels, Fish, Lakes, Lithuanian SSR, *Peracarida, Pontogammarus crassus, Pontogammarus robustoides, *Thermal stratification, *Lake Dusya(USSR), *Mesotrophy.

Mesotrophic Lake Dusya (the Baltic Sea Basin) (USSR) is distinguished for its rich species composition of Peracarida. It is inhabited by 4 spp. of endemics and 5 spp. of the Caspian complex trans-

planted from Kurshskian Bay and the Kaunas reservoir. During thermal stratification and under homothermal conditions the Peracarida inhabit mainly the littoral area (the greatest concentrations are observed to a depth of 13m). Benthic fish feed on Peracarida Pontogammarus (P. robustoides, P. crassus) is the basic food for eel.--Copyright 1977, Biological Abstracts, Inc.
W78-05737

EFFECTS OF HYDRAULIC DREDGING ON THE ECOLOGY OF NATIVE TROUT POPULATIONS IN WISCONSIN SPRING PONDS,
Wisconsin Dept. of Natural Resources, Waupaca. Bureau of Research.
R. F. Carline, and O. M. Brynildson.
Technical Bulletin, No. 98, 1977. 40 p, 19 fig, 29 tab, 41 ref, 5 append.

Descriptors: *Spring ponds, *Ponds, *Trout, *Dredging, *Wisconsin, *Environmental effects, *Sport fishing, Ecosystems, Spawning, Fish migration, Benthos, Food habits, Biological communities, Sedimentation, Costs, Fish populations, Krause Springs(WI), Sunshine Springs(WI), Groundwater, Aquatic plants, Fish management.

Dredging of spring ponds to increase living space for native trout populations such as brook trout, in an effort to reverse the natural aging process of pond filling, was begun in 1967 by the Wisconsin Department of Natural Resources. A study of the effects on pond ecology from 1977-75 indicated that the program is economically sound on the basis of increased fishermen utilization. Dredging costs ranged from $.52-$2.07/cu m of increased pond volume. Some 1700 spring ponds are found in northern Wisconsin. Two ponds were selected for intensive study, Krause Springs and Sunshine Springs. The standing crop of trout at Sunshine Springs five years after dredging nearly tripled from 36 to 90 kg/ha; fishing pressure increased from 94 to 896 hrs/ha, and catch increased from 69 to 481 trout/ha. At Krause Springs little change in standing crop was noted, but fishing pressure increased from 100 to 489 hrs/ha, and catch increased from 18 to 152 trout/ha. Dredging in the two ponds increased volumes by 400-500%. Aquatic macrophytes were completely eliminated, and recolonization was slow. Densities of benthic organisms, the primary trout food, were severely reduced. Tubificids, which previously accounted for only 4% of all organisms, became the most numerous taxa at 56-70% of all benthic organisms. None of the other taxa attained predredging levels after five years. (Lynch-Wisconsin)
W78-05739

COMBATING RIVER POLLUTION.
For primary bibliographic entry see Field 5G.
W78-05744

SOME TABLES AND REMARKS CONCERNING THE PELAGIC CRUSTACEAN-ASSOCIATION OF LAKE CONSTANCE 1952-1962, (IN GERMAN),
Staatliches Inst. fuer Seenforschung und Seenbewirtschaftung, Konstanz (West Germany). Abt. Max Auerbach-Inst.
R. Muckle, and G. Muckle-Rottengatter.
Arch Hydrobiol 78(4), p 415-455, 1976.

Descriptors: *Crustaceans, *Eutrophication, Lakes, *Pelagic crustaceans, *Lake Constance(West Germany), Water pollution effects.

The beginning eutrophication of the Lake Constance has changed the association and the cycles of the Crustacea-Plankton. Tables, remarks and discussions are given, to demonstrate these changes in comparison with classic results of Auerbach, Maerker and Schmalz (1924, 1926).--Copyright 1977, Biological Abstracts, Inc.
W78-05747

EFFECTS OF DEICING SALTS ON WOODY VEGETATION ALONG MINNESOTA ROADS,
Minnesota Univ., St. Paul. Coll. of Forestry.
For primary bibliographic entry see Field 5B.
W78-05786

EFFECTS OF DEICING SALTS AND LEAD UPON TREES, SHRUBS AND SOILS IN CONNECTICUT,
Connecticut Dept. of Transportation, Wethersfield. Bureau of Planning and Research.
For primary bibliographic entry see Field 5B.
W78-05787

THE BEHAVIORAL RESPONSES OF BLACKNOSE DACE, RHINICHTHYS ATRATULUS (HERMANN), TO DOMESTIC SEWAGE EFFLUENTS AND THEIR TOXIC CONSTITUENTS,
Maryland Univ., College Park.
J. A. Fava, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 577, Price codes: A07 in paper copy, A01 in microfiche. PhD Thesis, Physiology, 1975. 113 p, 8 fig, 14 tab, 113 ref. OWRT A-022-MD(1).

Descriptors: Fish, *Fish behavior, *Chlorine, *Sewage effluents, *Effluents, Toxicity, Fish toxins, Ammonia, Water pollution effects, *Chloramines, *Free chlorine, *Chlorinated sewage effluents, *Avoidance behavior, Lethal concentrations, Memory.

The ability of blacknose dace to detect and avoid domestic sewage effluents and their toxic constituents of free chlorine (Cl), chloramines, and ammonia was studied in the laboratory. An experimental chamber which allowed the fish to choose between clean water and test solutions was developed. Immediate responses (20-minute experimental period) and delayed responses (240 min period) were studied. The fish did not immediately avoid either unchlorinated sewage effluents or effluents chlorinated to 0.18 mg/l total Cl; they did avoid chlorinated sewage effluents at 0.51, 0.87, and 1.52 mg/l total Cl. In the free Cl solutions, initial preference, reduction in swimming activity, and mortality occurred but were not observed in the chloramine solutions or the chlorinated sewage effluents. In these solutions and effluents, the avoidance by fish was immediate and occurred at a lower total Cl concentration than in free Cl solutions, where fish showed avoidance only after initial preference. Fish exhibited delayed avoidance to free Cl and chloramine solutions as low as 0.07 mg/l total Cl. The median avoidance times for chloramine and free Cl solutions at the same total Cl concentrations were shorter than the median survival time, indicating that the fish can detect and avoid each solution before killed by it. Chloramines are the major cause of avoidance of chlorinated sewage effluents, which may explain the absence of fish below sewage outfalls in streams without evidence of fish kills. Experiments concerning role of memory of previous experiences in free Cl solutions of 0.17 mg/l total Cl were inconclusive. Fish did not immediately detect and avoid ammonia-nitrogen solutions as high as 270 mg/l. (Seip-IPA)
W78-05804

THE PHYSIOLOGICAL-HYGIENIC IMPORTANCE OF FLUORINE CONTENT IN DRINKING WATER, (IN RUSSIAN),
Kievskii Meditsinskii Inst. (USSR).
R. D. Gabovich, A. A. Minkh, and G. A. Stepanenko.
Vestn Akad Med Nauk SSSR 2, p 3-15, 1977.

Descriptors: Fluorides, Fluorine, Potable water, Public health, Water pollution effects, Water treatment, Cares, Human health, Nutrition, *USSR(Ivano-Frankovsk).

On the basis of the 30 yr studies in humans and mice a clear-cut relation between incidence rate of dental caries and the fluorine content in potable water was established. The high anti-caric effect of fluorine was corroborated by the results of the 10 yr study of fluoriniation of water in Ivano-Frankovsk (USSR). The effects of other ambient factors (nutrition, care of the oral cavity, etc.) on the incidence rate of caries are also discussed. The progress of implementation of fluorination of the main water in the Ukraine, as well as measures aimed at improvement and further development of the existing system are considered.--Copyright 1978, Biological Abstracts, Inc.
W78-05806

PHYSICAL AND CHEMICAL LIMNOLOGY AND CHLOROPHYLL-A CONTENTS IN THE PHYTOPLANKTON OF A MOUNTAIN LAKE LAKE SANTO PARMENSE, ITALY, (IN ITALIAN),
Parma Univ. (Italy). Lab. di Ecologia.
I. Ferrari, C. Bellavere, L. Camurri, and M. Catellani.
Riv Idrobiol 14(1/2), p 13-49, 1975.

Descriptors: Chemical limnology, *Chlorophyll, Italy, Lakes, *Limnology, Mountain lakes, Oxygen, Physical limnology, *Phytoplankton, *Lake Santo-Parmense(Italy), Stratification, Temperature, Seasonal, *Dimictic lakes, *Dissolved oxygen.

From June 1973-May 1974 Physical and chemical data were collected at Lago Santo Parmense. From June 16-Oct. 31, 1973 daily hydrological and meteorological data were collected to estimate the lake water budget: during this period the outflow was 500,000 m3, i.e., about half the lake volume. Santo is a dimictic lake, the maximum temperature is reached in the upper layers early in July. Transparency, expressed as Secchi disc visibility, varies from a minimum of 6.0 m to a maximum of 11.5 m: the lowest values were recorded in early June and late Sept. when a great deal of allochthonous materials was suspended in the water. The seasonal change in dissolved O2 concentrations is characterized by a noticeable hypolimnetic deficit at the height of summer stratification and during winter cover. The hypolimnetic areal O2 deficit was calculated. In summer there are metalimnetic O2 peaks. There is a good correlation between O2 concentrations and pH values. In summer pH is alkaline in epolimnetic and metalimnetic layers and acid hypolimnetic layers. Mean values of O2 and pH showed a decreasing trend during ice cover. Total alkalinity and conductivity increased significantly in the layers near the bottom, especially in winter.--Copyright 1977, Biological Abstracts, Inc.
W78-05820

PRODUCTIVITY OF ZOOPLANKTON IN DUVANKUL' LAKE IN THE SOUTHERN URALS, (IN RUSSIAN),
Siberian Research Inst. of the Fish Industry, Sverdlovsk (USSR). Ural Div.
I. V. Kozlova.
Gidrobiol Zh 12(5), p 25-30, 1976.

Descriptors: Cenological complexes, Cladocerans, Copepods, Daphnia-longispina, Diaphanosoma-brachyurum, Diaptomus-salinus, *Duvankul Lake(USSR), Plankton, *Productivity, Rotatorians, Southern Urals, *Zooplankton, Saline lakes, Eutrophication, Biomass.

The dynamics of species composition, quantity and biomass of zooplankton in the eutrophic salt lake Duvankul' (USSR) is known. Diaphanosoma brachyurum, Diaptomus salinus and Daphnia longispina are referred to the typical cenological complexes (including copepods, cladocerans and rotarians). (Diaptomus salinus was a year-round species in the lake.) Calculation of zooplankton production for the vegetative period of 1974 showed that it was created mainly in June-July;

Diaphanosoma brachyurium prevailed in the plankton (50r70% by biomass).--Copyright 1977, Biological Abstracts, Inc.
W78-05854

CORRELATION OF THE PROCESSES OF SYNTHESIS TO DESTRUCTION OF ORGANIC MATTER IN RELATION TO THE ANNUAL WATER CONTENT IN THE MOZHAISK RESERVOIR, (IN RUSSIAN),
Moscow State Univ. (USSR). Probl. Lab. Interaction Surface Underground Waters.
Yu. M. Lebedev, and E. L. Shirokova.
Gidrobiol Zh 12(5), p 20-24, 1976.

Descriptors: *Algae, Annual, *Mozhaisk Reservoir(USSR), *Primary productivity, Reservoirs, Russian SFSR, Stratification, Synthesis, Water pollution effects, Decomposing organic matter.

The total value of algal primary production and the destruction of organic matter in the Mozhaisk reservoir (Russian SFSR, USSR) was calculated monthly using the O2 method. The yearly biotic balance is made. For the years of observations (1967-1970) destruction of organic matter (R) exceeded the primary production (A). The ratio between gross primary production and destruction of organic matter in the years with low water content averaged 0.6, in the years with a greater water content it decreased to 0.3. The ratio of autochthonous and allochthonous organic matter as well as the character of water body stratification influence the value A/R.
W78-05874

FACTORS AFFECTING EFFLUENT QUALITY FROM FILL-AND-DRAW ACTIVATED SLUDGE REACTORS,
Purdue Univ., Lafayette, IN. Environmental Engineering Lab.
For primary bibliographic entry see Field 5D.
W78-05875

PHOTOTROPHIC PURPLE AND GREEN BACTERIA IN A SEWAGE TREATMENT PLANT,
Institut fuer Mikrobiologie der Gesellschaft fuer Strahlenund Umweltforschung mbH, Goettingen, West Germany.
For primary bibliographic entry see Field 5D.
W78-05883

EFFECTS OF TEMPERATURE FACTORS IN THE ACCUMULATION OF RADIOACTIVE NUCLIDES IN FISH, (IN RUSSIAN),
O. A. Balandin, and E. G. Repina.
Gig Sanit 1, p 114-115, 1977.

Descriptors: *Water temperature, *Thermal pollution, Cooling water, Reservoirs, Radioisotopes, *Cerium-144, *Cesium-137, Fish.

Accumulations of 137Cs and 144Ce in muscles and bones of fish in relation to water temperature of cooling reservoirs for atomic electrical plants were studied. Optimal water temperatures for fish growth (25 degrees C) produced accumulations of radioactive isotopes twice as high as with water temperatures of 15 degrees C (under laboratory conditions). Increasing water temperature from 0 to 17 degrees C increased accumulations of radioactive isotopes in tissues of fish (carp under 1 yr old) 2-10 times in comparison. This phenomenon was explained by increased metabolism of fish in warmer waters.--Copyright 1978, Biological Abstracts, Inc.
W78-05891

THE DEVELOPMENT OF HETEROTROPHIC BACTERIA IN CIRCULATING WATER SYSTEMS, (IN RUSSIAN),
Vsesoyuznyi-Nauchnyi Planovii Otdel Tsellyulozno-Bumazhnoi Promyshlennost, Leningrad (USSR).
N. A. Gavrishova, T. A. Dudarenko, S. A. Lashchenko, and A. A. Stolyarova.
Gidrobiol Zh 13(1), p 75-78, 1977.

Descriptors: *Heterotrophic bacteria, Pulp and paper industry, *Industrial wastes, Water reuse, *Biodegradation, Water pollution, Bacillus-mesentericus, Bacillus-subtilis, Disinfection, *Paperboard production.

The numbers of bacteria in circulating water used in paperboard production varied from 0.07-4.8 million/ml at a factory adding a higher volume of fresh river water to the cycle and 63-466 million/ml at a factory where the circulating water approximated a closed cycle. The density of bacterial contamination of the circulating water was a function of the bacterial population in the water entering the cycle, the rate of which the water was used and the bacterial contamination of the raw material (waste paper). The significant development of bacteria dominant in the waste paper microflora (principally the Bacillus subtillus-B. mesentericus group) in the circulating water and deposits on equipment indicated the importance of disinfecting the raw material when closed water systems are used.--Copyright 1978, Biological Abstracts, Inc.
W78-05893

NEW APPROACH TO BACTERIAL KINETICS IN WASTEWATER,
Syracuse Univ., NY. Dept. of Chemical Engineering and Materials Science.
G. F. Andrews, and C. Tien.
Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol 103, No EE6, p 1057-1074, December, 1977. 8 fig, 1 tab, 21 ref, 1 append.

Descriptors: *Activated sludge, *Bacteria, *Biochemical oxygen demand, *Biomass, *Model studies, Carbon, Nitrogen, Mathematical models, Growth rates, Flocculation, Waste water treatment, Liquid wastes.

A bacterial growth kinetics model is presented for the prediction of biomass growth and cell yield behavior based on substrate concentrations. The growth expressions predicted by this model are reduced to Monad-type rates for low, constant substrate concentrations. The kinetic model is examined with respect to data on the effects of dentrifying bacteria on dextrose metabolism. The kinetic model can be used to qualitatively predict the carbon to nitrogen ratio of the sludge during the activated sludge process. For a more accurate prediction, the relationship of substrate concentration to the carbon to nitrogen ratio must be clarified. The quantity of floc matrix material considered as stored substrate must also be determined. The kinetic model of bacterial growth also predicts the substrate uptake rates during contact stabilization, the delayed response of the activated sludge process after changes in influent concentration, and the difference between flow culture and batch culture cell yield. (Lisk-FIRL)
W78-05894

STUDY OF THE CONTAMINATION OF MARINE CULTURES, (IN FRENCH),
Centre d'Etudes et de Recherches de Biologie et d'Occanographie Medicale, Nice (France).
For primary bibliographic entry see Field 5B.
W78-05897

SEWAGE EFFLUENT ON PASTURE SHOWS LITTLE EFFECT.
For primary bibliographic entry see Field 5G.
W78-05898

THE PROBLEM OF POLLUTION IN THE MONTPELLIER REGION, (IN FRENCH),
For primary bibliographic entry see Field 5B.
W78-05906

OIL POLLUTION ON THE POLISH COAST OF THE BALTIC SEA, (IN POLISH),
K. Wolk.
Ochr Przyr 40, p 229-246, 1975.

Descriptors: *Oil pollution, Water pollution effects, *Birds, Clangula-Hyemalis, Mortality, *Baltic Sea, *Poland(Coastal area).

The oil menace on the Polish Coast of the Baltic Sea which occurs from Sept.-April and attains greater intensity from Nov.-March is discussed in relation to its effect on the shorebirds of the area, particularly the longtailed duck (Clangula hyemalis). Data are given for the number of dead birds as a direcrt result of this environmental pollution.--Copyright 1978, Biological Abstracts, Inc.
W78-05907

COASTAL WATER RESEARCH PROJECT. ANNUAL REPORT FOR THE YEAR ENDED 30 JUNE 1977.
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5B.
W78-05911

CHLORINATED BENZENES IN PALOS VERDES FLATFISH,
Southern California Coastal Water Research Project, El Segundo.
D. R. Young, and T. C. Heesen.
In: Southern California Coastal Water Research Project Annual Report for the Year Ended 30 June 1977, p 149-152, 1977. 1 tab, 2 ref.

Descriptors: *Baseline studies, *Environmental effects, Resources development, *Water pollution sources, *Water pollution effects, *Toxicity, Fish, Coasts, Benthos, Outer Continental Shelf, *Southern California Bight, Chlorinated benzenes(CB's), Dover sole, Flatfish, Ecosystems, Microstomus pacificus.

Municipal wastewaters discharged into southern California coastal waters contain relatively high concentrations of a newly identified series of chlorinated hydrocarbons, the chlorinated benzenes (CB's). The chlorinated benzenes are accumulated by Dover sole to a much smaller degree than are the PCB and DDT compounds. The results obtained to date sugest that despite the recent relatively high inputs of chlorinated benzenes off Palos Verdes Peninsula, levels of these contaminants are relatively low in benthic organisms from this coastal region. (See also W78-05911) (Sinha - OEIS)
W78-05920

METALS IN SEAFOODS NEAR OUTFALLS,
Southern California Coastal Water Research Project, El Segundo.
T. K. Jan, M. D. Moore, and D. R. Young.
In: Southern California Coastal Water Research Project Annual Report for the Year Ended 30 June 1977, p 153-157, 1977. 2 tab, 4 ref.

Descriptors: *Baseline studies, *Environmental effects, Resources development, *Water pollution sources, *Water pollution effects, *Heavy metals, Fish, Shellfish, Outfall sewers, Invertebrates, Toxicity, Chlorinated hydrocarbon pesticides, California, Outer Continental Shelf, Southern California Bight.

This study revealed no demonstratable metals contamination of the edible portion (Muscle) of the six fish species surveyed. There was some evidence of metals contamination in three of the six invertebrate species studied; however, with one major exception, mediam values of the metals in question in outfall specimens were never more than three to four times those measured in the controls. The outfall areas selected for this study were the Palos Verdes shelf, which is the site of the out-

fall system of Los Angeles County's Joint Water Pollution Control Plant (JWPCP), and the area off Newport Beach in which the Orange County Sanitation Districts' outfalls are located. (See also W78-05911) (Sinha - OEIS)
W78-05921

METALS IN MUSSELS FROM HARBORS AND OUTFALL AREAS,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5B.
W78-05922

A SAFE LEVEL OF HEXAVALENT CHROMIUM FOR A MARINE POLYCHAETE,
Southern California Coastal Water Research Project, El Segundo.
P. S. Oshida.
In: Southern California Coastal Water Research Project Annual Report for the Year Ended 30 June 1977, p 169-180, 1977. 3 fig, 4 tab, 13 ref.

Descriptors: *Baseline studies, *Environmental effects, Resources development, *Water pollution sources, *Water pollution effects, *Chromium, Toxicity, Water quality, California, *Outer Continental Shelf, Southern California Bight, Polychaeta, Neanthes arenaceodentata.

Experiments have been conducted to determine the maxiumum seawater concentration of hexavalent chromium that is safe for a marine polychaete, Neanthes arenaceodentata, and to investigate the possible association between tissue accumulation of chromium in the polychaete and alterations in its reproduction (specifically, in number of offspring). Although there are undoubtedly specific differences in reactions to hexavalent chromium exposure, data suggest that N. arenaceodentata accumulates chromium in proportion to the ambient water concentration and that most of the accumulated chromium is located in the body wall, gut wall, and parapodial regions. Although this experiment resulted in no acute effects of individual N. arenaceodentata, the work revealed chronic effects, which were reduction in the numbers of offspring and bioaccumulation of chromium in the tissues. (See also W78-05911) (Sinha - OEIS)
W78-05923

EFFECTS OF HEXAVALENT CHROMIUM ON SEA URCHIN EMBRYOS AND BRITTLE STARS,
Southern California Coastal Water Research Project, El Segundo.
P. S. Oshida, and J. L. Wright.
In: Southern California Coastal Water Research Project Annual Report for the Year Ended 30 June 1977, p 181-185, 1977. 6 ref.

Descriptors: *Baseline studies, *Environmental effects, Resources development, *Water pollution sources, *Water pollution effects, *Chromium, Toxicity, California, *Outer Continental Shelf, Southern California Bight, Hexavalent chromium, Sea urchins, Brittle stars, Ophiothrix spiculata, Strongylocentrotus purpuratus.

A species of brittle star, Ophiothrix spiculata, appears to be as acutely sensitive to hexavalent chromium as the polychaete, Neanthes arenaceodentata--the species that had been shown to be most sensitive in previous comparisons. Work completed in the past year and described here, has revealed that the two species have very similar acute sensitivities to hexavalent chromium. Tests of the effects of hexavalent chromium on the development of sea urchin embryos are also described. Tests were designed to identify the levels of hexavalent chromium that interfere with the early embryological stages of development in the sea urchin, Strongylocentrotus prupuratus. Results indicate that there is a concentration between 2.9 and 29 gm hexavalent chromium/liter that causes a 50% reduction in the numbers of normally developing embryos. (See also W78-05911) (Sinha - OEIS)
W78-05924

TOXICITY OF A CHLORINATED BENZENE TO SEA URCHIN EMBRYOS,
Southern California Coastal Water Research Project, El Segundo.
P. S. Oshida.
In: Southern California Coastal Water Research Project Annual Report for the Year Ended 30 June 1977, p 187-192, 1977. 3 fig, 5 ref.

Descriptors: *Baseline studies, *Environmental effects, Resources development, *Water pollution effects, *Sediments, Aquatic life, Toxicity, Embryos, California, *Outer Continental Shelf, Southern California Bight, Chlorinated benzene, Sea urchin, Stongylocentrotus purpuratus, Dichlorobenzene(o-DCB).

The study described here was a preliminary investigation of a chlorinated benzene compound, ortho-dichlorobenzene's (o-DCB) potential as a mitotic poison in the marine environment. Recently fertilized sea urchin eggs were exposed to an o-DCB concentration of about 21 mg/liter, and their development morphology and rate were observed during the subsequent 52 hours. The results showed that o-DCB has the potential to interfere with embryological development: Gossly abnormal sea urchin embryos were evident at about 28 hours past fertilization. (See also W78-05911) (Sinha - OEIS)
W78-05925

MARINE BIRD DEATHS AT LOS ANGELES ZOO,
Southern California Coastal Water Research Project, El Segundo.
D. R. Young, and T. C. Heesen.
In: Southern California Coastal Water Research Project Annual Report for the Year Ended 30 June 1977, p 193-198, 1977. 3 tab, 3 ref.

Descriptors: *Baseline studies, *Environmental effects, Resources development, *Water pollution effects, *Toxicity, DDT, Birds, Pesticide residues, Path of pollutants, *Southern California Bight, Cormorants, Gulls.

During the spring of 1976, nearly the entire collections of Brandt's cormorants (Phalacrocorax penicillatus), guanay cormorants (P. bougainvillii), and California gulls (Larus californicus) in the Los Angeles County Zoo died after exhibiting signs of pesticide poisoning. The study revealed that levels of DDT residues in the specimens were within the range that had been found to be lethal to American kestrels in laboratory feeding studies. The zoo birds apparently were exposed to the DDT when they were fed fish collected in the general vicinity of Palos Verdes Peninsula. Results of tests show another indication that, despite termination of the dominant DDT input to the JWPCP municipal wastewater system in 1970, potentially toxic levels of DDT residues are still found in certain fishes occupying the discharge region off the Palos Verdes Peninsula. (See also W78-05911) (Sinha - OEIS)
W78-05926

ANIMALS THAT ARE INDICATORS OF MARINE POLLUTION,
Southern California Coastal Water Research Project, El Segundo.
In: Southern California Coastal Water Research Project Annual Report for the Year Ended 30 June 1977, p 199-206, 1977. p 199-206, 1977. 4 fig, 8 re

Descriptors: *Baseline studies, *Environmental effects, Resources development, *Water pollution effects, *Bioindicators, Benthos, Invertebrates, Toxicity, Municipal wastes, California, Southern California Bight, Polychaeta, Pelecypoda, Ophiuroids.

Indicator species are those whose changes in abundance reflect overall changes in the normal patterns of invertebrate communities. By monitoring the changes in a few selected indictor species, the expense of biological monitoring can be drastically decreased. The objectives of this study were to select indicator species for five southern California areas that receive major discharges of municipal wastewaters. The result was the identification of four groups of indicator species, containing a total of nine soutern California subtaida benthic invertebrates, which did in fact--by their abundances--define the areas of impact around each of the five discharg locations. (See also W78-05911) (Sinha - OEIS)
W78-05927

HISTOLOGY OF LIVER TISSUE FROM DOVER SOLE,
Southern California Coastal Water Research Project, El Segundo.
K. V. Pierce, B. McCain, and M. J. Sherwood.
In: Southern California Coastal Water Research Project Annual Report for the Year Ended 30 June 1977, p 207-212, 1977. 4 fig, 3 ref.

Descriptors: *Baseline studies, *Environmental effects, Resources development, *Water pollution effects, *Bottom sediments, Fishes, DDT, Polychlorinated biphenyls, Toxicity, *Outer Continental Shelf, Southern California Bight, Histology, Dover sole, Chlorinated hydrocarbons.

In southern California studies, Dover sole (Microstomus pacifucus) collected from the Palos Verdes shelf have been found to have enlarged livers, as have individuals of this species exposed to Palos Verdes sedinment in the laboratory. The objectives of this preliminary study were to determine (1) if there were differences between the histologic characteristics of the livers of Dover sole collected from the Palos Verdes shelf and those of specimens from a control area and (2) if these differences were similar to those found in populations of English sole and starry flounder from contaminated and control areas in Seattle waters. In both areas, the bottom sediments and the fish themselves are contaminated with chlorinated hydrocarbons--PCB's in the Duwamish River Estuary and PCB's and DDT's off Palos Verdes. (See also W78-05911) (Sinha - OEIS)
W78-05928

FIN EROSION DISEASE AND LIVER CHEMISTRY: LOS ANGELES AND SEATTLE,
Southern California Coastal Water Research Project, El Segundo.
M. J. Sherwood.
In: Southern California Coastal Water Research Project Annual Report for the Year Ended 30 June 1977, p 213-219, 1977. 1 fig, 4 tab, 4 ref.

Descriptors: *Baseline studies, *Environmental effects, Resources development, *Water pollution effects, Fish diseases, Waste disposal, Metals, Toxicity, California, Washington, New York, *Dunwamish River Estuary(Wash), *Outer Continental Shelf, *Southern California Bight, *New York Bight, Fin erosion, Liver disease, Dover sole, Starry flounder.

Marine flatfishes with fin erosion diseases have been found in three coastal regions of the United States in which toxic wastes have been discharged-southern California, the Duwamish River Estuary in Seattle, Washington, and the New York Bight. Similarities in the nature of the diseases and in the distribution of affected individuals in each region have suggested the possibility that the diseases have a common cause related to the discharge of toxic wastes. A comparison of the levels of seven trace metals in the

liver tissue of Dover sole and starry flounder suggests that patterns in increase and decrease between specimens from control sites were not the same in the two regions. A possible exception is the depression in cadmium levels, which was evident in starry flounder in this study and has been reported previously in Dover sole from southern California. The occurrence of enlarged livers in specimens from the high-disease-prevalence sites in both regions and the measurement of increased amounts of lipid in the livers of Palos Verdes Dover sole suggest, with histologic observations, that liver damage is occurring at these sites and that it may precede the appearance of fin erosion. (See also W78-05911) (Sinha - OEIS)
W78-05929

FIN REGENERATION IN DOVER SOLE,
Southern California Coastal Water Research Project, El Segundo.
M. J. Sherwood.
In: Southern California Coastal Water Research Project Annual Report for the Year Ended 30 June 1977, p 221-224, 1977. 1 fig, 1 tab, 6 ref.

Descriptors: *Baseline studies, *Environmental effects, Resources development, *Water pollution effects, Fish diseases, Southern California Bight, Fin erosion, Tissue regeneration, Dover sole.

The objective of this study was to determine if local Dover sole maintained in the laboratory could regenerate portions of their dorsal and anal fins that had been artificially removed. Information on the ability of individuals to regenerate their fins might shed light on the process by which fin erosion takes place in the field. The Dover sole used in this experiment were selected from collections of fish taken by otter trawl off Palos Verdes and Point Dume in September 1976 and maitained for up to 10 weeks in recirculating aquaria in the Project's laboratory. The results of this study suggest that Dover sole are able to repair and regenerate dorsal fin tissue. It is therefore possible that these processes are occurring in the field. However, the percentage of individuals with fin erosion in which repair and regrowth take place appears to be low. Laboratory data support this conclusion to some extent. (See also W78-05911) (Sinha - OEIS)
W78-05930

HYDROGEOLOGY OF THE LAKE METIGOSHE BASIN NORTH DAKOTA AND MANITOBA,
North Dakota Univ., Grand Forks. Dept. of Geology; and Geological Survey, Grand Forks, ND.
For primary bibliographic entry see Field 5B.
W78-05933

THE USE OF SATELLITE IMAGERY FOR LAKE CLASSIFICATION IN WISCONSIN,
Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2H.
W78-05935

METHODOLOGY FOR ANALYZING EFFECTS OF URBANIZATION ON WATER RESOURCE SYSTEMS,
Texas Univ. at Austin. Dept. of Civil Engineering.
L. W. Mays, and Y.-K. Tung.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 663, Price codes: A08 in paper copy, A01 in microfiche. Center for Research in Water Resources, Technical Report No CRWR-156, January 1978. 158 p, 33 fig, 6 tab, 60 ref, 5 append. OWRT A-043-TEX(1). 14-34-0001-7092.

Descriptors: State variable modeling, Lumped mathematical model, Nonlinear hydrologic system model, *Urbanization, Statistical analysis, *Texas, *Model studies, Mathematical models, Methodology, Sewers, Networks, Watershed management, Waller Creek Watershed(Tex), Austin(Tex).

A technique called state variable modeling which is relatively new to water resources has been applied to analyze two major phases of the urban water resources system. The first phase is based upon a lumped mathematical model to describe unsteady, nonuniform sewer flow in terms of a set of first order ordinary differential equations. This model can be used to route urban storm water through multi-level branching sewer networks. The model is compared with other routing techniques through the use of an example sewer network. For the second phase a nonlinear hydrologic system model has been formulated in the state variable form. Hydrograph analysis in conjunction with optimization search technique is performed to thirty-seven rainfall storm events in the period of fifteen years on a watershed in order to examine how the model parameters vary with levels of urbanization. Statistical analysis is used to suggest general trend equations for the model parameters.
W78-05938

THE BACTERIAL POLLUTION OF THE COASTAL WATERS OF THE PROVINCE OF ROME, (IN ITALIAN),
Ufficio Medico Provincial di Rome (Italy).
P. Zucchetti, B. Cisbani, M. Floccia, and G. Palmieri.
Ann Sclavo 17(4), p 543-562, 1975.

Descriptors: *Bacteria, Water pollution effects, Coastal waters, *Italy(Rome coastal area), Waste disposal, Sewage disposal, *Fecal coliforms, Hepatitis, Human diseases, Sewage, Typhoid.

Because of the dangers of infection by hepatitis, typhoid, and fecal coliforms, a 4 yr study was made which included 2400 samples from 440 locations along the coast of the province. A list of the local communities was compiled and the number of inhabitants, bodies of water, type of sewage, sewage discharge location and water purification systems were reported. Data on fecal coliform concentrations from different sections of the coastline are given. Along a 140 km coast, of which 120 km are used for bathing, 12 km were declared unit for bathing, 21 km required further examinations and 87 km were considered suitable for bathing.--Copyright 1978, Biological Abstracts, Inc.
W78-05948

ACUTE TOXICITY OF UN-IONIZED AMMONIA TO FINGERLING COHO SALMON,
Metro Water Quality Lab., Seattle, WA.
J. A. Buckley.
The Progressive Fish-Culturist, Vol. 40, No. 1, January 1978, p 30-32, 2 tab, 16 ref.

Descriptors: Environmental effects, *Water pollution effects, *Ammonia, Salmon, Fry, *Toxicity, Mortality, Fingerlings, *Sockeye salmon, Lethal limit, Sewage effluents, Un-ionized ammonia.

Hatchery-reared coho salmon were acclimated to river water (un-ionized ammonia <0.001 mg/l) for 7 days and were then exposed in groups of 10 fish each to 9 concentrations of un-ionized ammonia ranging from <0.001 to 0.910 mg/l for a period of 96 h. The 96-h LC50 was 0.45 mg un-ionized ammonia per liter, with 95% confidence limits of 0.43 to 0.47. The highest concentration tested with no acute effect was 0.178 mg/l. (Chilton-ORNL)
W78-05952

EFFECT OF DISSOLVED OXYGEN ON THE SURVIVAL AND HATCHING OF EGGS OF SCALE CARP,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Zoology-Entomology.
K. Kaur, and H. S. Toor.
The Progressive Fish-Culturist, Vol. 40, No. 1, January 1978, p 35-37, 1 tab, 23 ref.

Descriptors: Environmental effects, *Dissolved oxygen, Mortality, Hatching, *Carp eggs, *Water pollution effects, Growth stages, Growth rates, Fish eggs, *Embryonic growth stage, Incubation.

Freshly fertilized eggs of scale carp were exposed to dissolved oxygen (DO) levels of approximately 12.0, 9.0, 6.0, 3.0, 1.2, and 0 mg/l. Survival and hatching rate were seen to increase directly with increasing concentrations of DO. Levels below 6.0 mg/l were inadequate for survival. It was observed that embryos became more sensitive to low concentrations as development advanced. (Chilton-ORNL)
W78-05953

POTENTIAL TOXICITY OF TACONITE TAILINGS TO AQUATIC LIFE IN LAKE SUPERIOR,
Reserve Mining Co., Silver Bay, MN.
J. R. Oxberry, P. Doudoroff, and D. W. Anderson.
Journal Water Pollution Control Federation, Vol. 50, No. 2, February 1978, p 240-251, 5 ref.

Descriptors: Environmental effects, *Water pollution effects, *Lake Superior, Waste water(Pollution), Fish, Invertebrates, *Toxicity, Juveniles, Trout, Rainbow trout, Brook trout, Yellow perch, Aquatic life, Bioassay, Mining, Metals, Mine wastes, Tailings, *Taconite tailings.

Investigations were made on the effects of continuous exposure to fish and invertebrate animals to Reserve Mining Company's tailings launder effluent, a slurry of taconite tailings. The test animals were juvenile rainbow trout, brook trout, yellow perch, adult amphipods, and opossum shrimp. Tests with juvenile fish lasted for 22 to 49 days and those with invertebrates for 98 to 363 days. No adverse effects of exposure were observed. Continuous exposure to partially clarified and periodically renewed tailings launder effluent also had no adverse effect on the hatching of eyed eggs of rainbow trout and lake trout and on the survival of the hatching larvae. It was concluded that under no conceivable circumstances could the somewhat alkaline waters of Lake Superior be rendered even slightly toxic to fish by the discharge into the lake of taconite tailings and their deposition on the lake bottom. (Chilton-ORNL)
W78-05954

EFFECTS OF POLLUTANTS ON NATALITY OF MUSCULIUM SECURIS (BIVALVIA:PISIDIIDAE),
Guelph Univ., (Ontario). Dept. of Zoology.
G. L. Mackie.
The Nautilus, Vol. 92, No. 1, January 1978, p 25-33, 4 tab, 42 ref. National Research Council of Canada A2386 and A9882.

Descriptors: Environmental effects, *Water pollution effects, Pollutants, Temperature, Wastes, Domestic wastes, Water pollution sources, Sewage, Reproduction, Salts, Sodium chloride, Sulfates, *Bioindicators, *Natality, Sphaeriids, Slaughterhouse wastes, Road salts, *Musculium securis.

The objectives were to determine the effects of some common pollutants, temperature, road salts, sulfate, domestic and slaughterhouse wastes, and pulp and paper effluent on the natality of Musculium securis and to assess the use of sphaeriid natality as an index for assessment of water quality. Laboratory experiments showed optimum reproduction to be near 18C with significant reduction below 10C and above 25C. In tests of road salts, sodium chloride was found to have greater adverse effects than did calcium chloride. Concentrations of sulfate less than 100 mg/l had no significant effect on natality of M. securis. There was not

reproduction in a creek carrying raw sewage and slaughterhouse wastes. Natalities of M. securis were significantly greater above outfall of pulp and paper wastes than below the outfalls and tended to increase with increasing distance below the outfalls. It was concluded that natality is potentially a good index for assessment of water quality. (Chilton-ORNL)
W78-05956

EFFECTS OF CLIMATIC CYCLES ON THE RELATIVE ABUNDANCE AND AVAILABILITY OF COMMERCIAL MARINE AND ESTUARINE SPECIES,
Maine State Dept. of Marine Resources, Augusta.
For primary bibliographic entry see Field 2L.
W78-05957

IMPORTANCE OF EELGRASS BEDS IN PUGET SOUND,
National Marine Fisheries Service, Beaufort, NC. Beaufort Lab.
For primary bibliographic entry see Field 2L.
W78-05958

DIVERSITY AND DISTRIBUTION OF MUSSELS (BIVALVIA: UNIONACEA) IN A EUTROPHIC RESERVOIR, LAKE ASHTABULA, NORTH DAKOTA,
North Dakota Univ., Grand Forks. Dept. of Geology.
A. M. Cvancara, and P. G. Freeman.
The Nautilus, Vol. 92, No. 1, January 1978, p 1-9, 1 fig, 5 tab, 19 ref.

Descriptors: Environmental effects, *Trophic levels, Lakes, *Mussels, Oxygen, Reproduction, *Eutrophication, *North Dakota, Reservoirs, Water pollution effects, *Lake Ashtabula(ND), Sheyenne River(ND).

Lake Ashtabula is a 28-year-old eutrophic reservoir on the Sheyenne River in southeastern North Dakota. Surveys showed that there are considerably fewer mussel species found in the lake than are known to exist in the river above and below the lake. Those found in the lake were the same species as those found at most stations in the river. It was suggested that possible causes for fewer mussel species in the lake are alteration of reproductive processes and periodic low levels of oxygen content. (Chilton-ORNK)
W78-05959

STRUCTURE OF PELAGIC FOOD CHAIN AND RELATIONSHIP BETWEEN PLANKTON AND FISH PRODUCTION,
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia). Marine Ecology Lab.
For primary bibliographic entry see Field 2L.
W78-05961

THE CYCLE OF HEAVY METALS IN LAKES, (IN GERMAN),
Eidgenoessische Anstalt fuer Wasservorsorgung, Abwasserreinigung und Gewaesserschutz, Kastienbaum (Switzerland). Seenforschungslab.
For primary bibliographic entry see Field 5B.
W78-05962

CHLORDANE CONTAMINATION OF A MUNICIPAL WATER SYSTEM,
Center for Disease Control, Atlanta, GA. Environmental Hazards Activity, Cancer and Birth Defects Div.
J. M. Harrington, E. L. Baker, Jr, D. S. Folland, J. W. Saucier, and S. H. Sandifer.
Environmental Research, Vol. 15, No. 1, February 1978, p 155-159, 1 fig, 1 tab, 11 ref.

Descriptors: Water quality, *Water pollution effects, *Pesticides, *Chlordane, Municipal water, Tennessee, *Public health, Human diseases.

An episode is documented of pesticide (chlordane) contamination of a segment of a municipal water system. Thirteen persons (18% of affected residents) exposed to contaminated water reported mild symptoms consistent with chlordane exposure. Symptoms did not persist and chronic damage was not observed. Contamination probably occurred because of careless handling of a concentrated chlordane solution. It was estimated that approximately a quart of concentrated pesticide entered the water supply. A rise in oxychlordane levels in the symptomatic residents may have been related to redistribution form fat where chlordane was deposited after acute exposure or to seasonal variation in levels. (Chilton-ORNL)
W78-05963

EFFECTS OF DIETARY ADDITION OF VITAMINS C AND D3 ON GROWTH AND CALCIUM AND PHOSPHORUS CONTENT OF POND-CULTURED CHANNEL CATFISH,
Kansas State Univ., Manhattan. Div. of Biology.
C. A. Launer, O. W. Tiemeier, and C. W. Deyoe.
The Progressive Fish-Culturist, Vol. 40, No. 1, January 1978, p 16-20, 2 fig, 3 tab, 24 ref.

Descriptors: Environmental effects, *Fish diets, *Channel catfish, Nutrient requirements, *Vitamins, *Calcium, *Phosphorus, Dietary supplement, Vitamin C, Vitamin D3.

Similar weight gains, feed conversions, and survival for fingerling channel catfish fed diets contaning Vitamin C, Vitamin D3, or both, indicated that no increase in growth was achieved by adding those vitamins to the diet. Sampling data differences showed that calcium and phosphorus levels in catfish do vary but no direct correlation was seen between levels of vitamin C or D3 and the calcium and phosphorus in eviscerated bodies and fat-free skeletons of fingerlings. (Chilton-ORNL)
W78-05964

PHOSPHORUS LOADING AND RESPONSE IN LAKE VANERN NEARSHORE AREAS,
National Swedish Environmental Protection Board, Uppsala.
E. B. Welch, and L. T. Lindell.
Environmental Science and Technology, Vol 12, No 3, March 1978, p 321-327, 5 fig, 6 tab, 13 ref.

Descriptors: Environmental effects, *Phosphorus, Trophic levels, Lakes, Retention, Nutrients, Forecasting, *Water pollution effects, *Lake Vanern(Sweden), *Waste assimilative capacity, *Waste loading, Estimating.

Five nearshore areas of Lake Vanern were studied during 1973-75 to determine present trophic state, their effect on whole lake P retention, and effects of changed nutrient loading. Phosphorus concentration was predicted from known P loading, flushing rate, water distribution, and estimated retention coefficients in the areas. Five archipelagic areas retained about 38% of the P load and the open lake retained a similar fraction. On-half of the incoming P was retained in nearshore areas. Predicted P content agreed reasonably well with observed, and even estimates of chlorophyll a content from predicted P fell largely within the confidence intervals of chlorophyll a previously predicted from observed P concentrations for whole lake systems. It was concluded that with reasonably good data on P loading, retention coefficient, and flushing rate, predictions of trophic state changes and retention capacity are possible in archipelagic areas of large lakes. (Chilton-ORNL)
W78-05966

SEASONAL CHANGES IN THE COMMUNITY STRUCTURE OF THE MACROBENTHOS INHABITING THE INTERTIDAL SAND AND MUD FLATS OF BARNSTABLE HARBOR, MASSACHUSETTS,
Chicago Univ., IL. Committee on Evolutionary Biology.
For primary bibliographic entry see Field 2L.
W78-05967

PRODUCTION OF CHIRONOMUS, PROCLADIUS, AND CHAOBORUS AT DIFFERENT LEVELS OF PHYTOPLANKTON BIOMASS IN LAKE MEMPHREMAGOG, QUEBEC-VERMONT,
McGill Univ., Montreal (Quebec). Dept. of Biology.
R. M. Dermott, J. Kalff, W. C. Leggett, and J. Spence.
Journal of the Fisheries Research Board of Canada, Vol 34, No 11, November 1977, p 2001-2007, 2 fig, 2 tab, 23 ref.

Descriptors: Environmental effects, Biological communities, Nutrients, Lakes, Trophic levels, *Productivity, Benthos, Standing crop, *Lake Memphremagog(Quebec), *Canada, *Water pollution effects, *Eutrophication, *Biomass.

The Lake Memphremagog Study, initiated in 1972, seeks to quantify the response of communities occupying various trophic levels to the pronounced nutrient gradient that occurs along the long (north-south) axis of the lake. The mean annual benthic standing stock in the south basin was found to be 2.8 times greater than in the north basin. Mean annual standing stock of Procladius denticulatus and Chironomus anthracinus were 5.8 and 3.1 times, respectively, higher in the south basin. No significant difference was noted in standing stock of Chaoborus puncipennus between the two areas. Annual production of C. punctipennis was greater in the north while it was greater for the other two species in the south. Daily P:B ratios did not differ significantly between basins for the two species exhibiting increased biomass and production in the more productive southe basin, in spite of the differences in the availability of food there. (Chilton-ORNL)
W78-05968

NUTRIENT ENRICHMENT AND EUTROPHICATION OF LAKE MICHIGAN,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
C. L. Schelske, and C. O. Davis.
Available from the National Technical Information Service, Springfield, VA 22161 as COO-2003-26, Price codes: A02 in paper copy, A01 in microfiche. Prepared for Energy Research and Development Administration, Report No. COO-2003-26, 1975/76. 15 p, 6 fig, 4 tab, 5 ref. AT(11-1)-2003.

Descriptors: *Nutrients, *Eutrophication, *Lake Michigan, Phytoplankton, Algae, Diatoms, Phosphorus, Silica, Nitrogen, Chlorophyll, Great Lakes, Lakes, Tributaries, Grand River(MI), Species composition, Limiting factors, Chemostats, Stratification, Michigan, Wisconsin.

Relationships between phytoplankton and major nutrients (phosphorus, silica, and nitrogen) in Lake Michigan are discussed in a report on four studies in progress: (1) open lake, (2) tributaries, (3) Grand River, and (4) diatom chemostat studies. Open lake studies have been conducted since 1972 on changes in phytoplankton species composition and nutrients. The size of the spring phytoplankton bloom is controlled by phosphorus supply, while the summer standing crop minimum results from nutrient depletion in the epilimnion. Since nitrate is never depleted in the open waters, nitrogen supply has virtually no effect of chlorophyll standing crops. Silica is limiting in spring and summer in the epilimnion, with a change from diatom domination to chlorophyte dominance. This shift in species composition is apparently a recent phenomenon related to

phosphorus loading. In summer, diatom domination persists in subsurface waters where adequate silica supplies remain. Lake Huron is a source of silica through the Straits of Mackinac. Tributary studies in 1972 showed chemical and phytoplankton compositions different from the open lake. Nutrient levels in the Grand River, surveyed in 1974-76, were always high during high flow; diatoms made up 98% of phytoplankton near the river mouth. A chemostat system for diatom studies was put into operation in January 1976, but initial experiments were unsuccessful. (Lynch-Wisconsin)
W78-05970

BACTERIAL CONTAMINATION OF LAKE POWELL WATERS: AN ASSESSMENT OF THE PROBLEM,
New Mexico Univ., Albuquerzque. Dept. of Biology.
For primary bibliographic entry see Field 5B.
W78-05972

ENVIRONMENTAL STATUS OF THE LAKE MICHIGAN REGION, VOLUME 4. PHYTOPLANKTON OF LAKE MICHIGAN,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environment Research Lab.
S. J. Tarapchak, and E. F. Stoermer.
Available from the National Technical Information Service, Springfield, VA 22161 as ANL/ES-40, Price codes: A10 in paper copy, A01 in microfiche. Technical Report ANL/ES-40, Argonne National Laboratory, Illinois, December 1976. 211 p, 89 fig, 37 tab, 249 ref.

Descriptors: *Environmental effects, *Trophic level, *Lake Michigan, *Phytoplankton, *Baseline studies, *Algae, *Distribution, Primary productivity, Diatoms, Eutrophication, Cyanophyta, Chlorophyta, Lakes, Great Lakes, Phosphorus, Nutrients, Model studies, Seasonal, Green Bay(WI), Wisconsin, Basic data collections.

As part of an overall baseline assessment of the environmental status of Lake Michigan a compilation of published data on phytoplankton in the lake includes an evaluation of trophic level. Phytoplankton abundance and primary productivity vary seasonally, but generally are higher and more variable inshore than offshore. Seasonal phytoplankton development in the central basin is bimodal in southern and nearshore waters, but unimodal with a summer peak offshore. Critical water temperatures and higher nutrient concentrations in the southern basin and critical mixing depths are responsible for these dissimilarities. A trend toward serious cultural eutrophication is evidenced by a significant increase in algal abundance inshore near Milwaukee and Chicago, and by a shift in the southern basin offshore community from the historical dominance by diatoms to a notable fraction of chlorophytes and cyanophytes. These trends are attributed to increases in phosphorus loading rates, which have reached unacceptable levels in southern Green Bay and some inshore regions of the southern and central basins. Lake Michigan's trophic state generally is intermediate between that of Lake Superior and the western basin of Lake Erie. Since the year 1900, over 200 taxa of algae have been recorded in open water in the lake. Of these, 1300 diatoms have been identified and the remaining 700-800 divided among other algal groups. (Lynch-Wisconsin)
W78-05973

ENVIRONMENTAL STATUS OF THE LAKE MICHIGAN REGION, VOLUME 6. ZOOBENTHOS OF LAKE MICHIGAN,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
S. C. Mozley, and R. P. Howmiller.
Available from the National Technical Information Service, Springfield, VA 22161 as ANL/ES-40, Price codes: A07 in paper copy, A01 in microfiche. Technical Report ANL/ES-40, Argonne National Laboratory, Illinois, September 1977. 148 p, 59 fig, 13 tab, 291 ref.

Descriptors: *Environmental effects, *Benthic fauna, *Lake Michigan, *Baseline studies, *Bioindicators, *Tubificids, *Benthos, *Macroinvertebrates, Oligochaetes, Pontoporeia affinis, Great Lakes, Green Bay(WI), Methodology, Research equipment, Water quality indexes, Species composition, Sampling, Amphipoda, Species diversity, Basic data collections, Lakes.

As part of a series of baseline assessments of the environmental status of Lake Michigan, this summary of zoobenthic studies through mid-1974 includes power plant surveys and describes the ecology of macroinvertebrates and some microfauna. Conclusions include: (1) zoobenthos are dominated by the amphipod Pontoporeia affinis; (2) tubificid oligochaetes are useful in mapping environmental quality; and (3) there are pronounced qualitative gradients in zoobenthos related to depth. Sampling techniques are compared and evaluated, including the following samplers: Smith-McIntyre, Ponar, Petersen, orange peel, and Ekman grab samplers, and the free-falling corer and Fager hand-corer. Most studies prior to 1965 used the relatively inefficient Petersen sampler, and the superior Ponar sampler has since become the most widely used; comparative use of older data is therefore difficult. Also discussed are zoobenthic pollution indicators; zoobenthic effects on sediment-water exchanges; and total macroinvertebrate numbers, biomass, and production. The autecology of Arthropoda (Crustacea, Insecta), Mollusca (Gastropoda, Pelecypoda), and Annelida (oligochaeta, Hirudinea) is described. No simple relationship has been found between species diversity and pollution among Great Lakes macrobenthos, but changes in species composition (relative abundance) have provided useful indices of eutrophication and pollution. Such indicators in Green Bay have been extensively studies. (Lynch-Wisconsin)
W78-05974

ENVIRONMENTAL STATUS OF THE LAKE MICHIGAN REGION, VOLUME 14. BIRDS OF THE LAKE MICHIGAN DRAINAGE BASIN,
Michigan State Univ., East Lansing.
G. J. Wallace.
Available from the National Technical Information Service, Springfield, VA 22161 as ANL/ES-40, Price codes: A06 in paper copy, A01 in microfiche. Technical Report ANL/ES-40, Argonne National Laboratory, Illinois, July 1977. 112 p, 1 fig, 6 tab, 82 ref, 1 append.

Descriptors: *Environmental effects, *Birds, *Lake Michigan basin, *Baseline studies, *Migratory birds, *Faunal lists, Habitats, Basic data collections, Great Lakes, Lakes, Migration patterns, Pesticides, Wisconsin, Michigan, Illinois, Indiana, Basins, Checklists, Wildlife, Wildfowl.

Birds of Lake Michigan's drainage basin are discussed as part of a series of baseline assessments of the environmental status of the lake. Wildfowl found in one hundred counties of Wisconsin, Michigan, Illinois and Indiana are described in terms of habitat (including state parks, lakeshores, refuges, and sanctuaries), patterns of historical occurrence and abundance, migration patterns, and the influence of disease, hunting pressure, pesticides and pollution. An extensive annotated list of species regularly found in the basin includes additional lists of extinct, extirpated, endangered, threatened, declining, and introduced species. Of some 360 species recorded in the watershed in the past century, at least 264 currently occur regularly as permanent or summer residents or as transients. More than 90% are migratory, the majority nocturnal. Spring migration in the northern states is concentrated in April and May; fall migration extends from July to November, with a maximum number of species migrating in September. Major habitats include: (1) the Lake Michigan shoreline (loons, grebes, waterfowl, gulls, sandpipers); (2) inland lakes (Ducks, kingfishers, spotted sandpipers); (3) rivers and streams (herons, river ducks, eagles, ospreys); (4) marshes (numerous birdlife); (5) fields and open spaces (bobolinks, meadowlarks, horned larks, sparrows); and (6) woodlots (about 80 species). (Lynch-Wisconsin)
W78-05975

ENVIRONMENTAL STATUS OF THE LAKE MICHIGAN REGION, VOLUME 16. AMPHIBIANS AND REPTILES OF THE LAKE MICHIGAN DRAINAGE BASIN,
Wisconsin Univ.-Madison. Dept. of Zoology.
E. D. Pentecost, and R. C. Vogt.
Available from the National Technical Information Service, Springfield, VA 22161 as ANL/ES-40, Price codes: A04 in paper copy, A01 in microfiche. Technical Report ANL/ES-40, Argonne National Laboratory, Illinois, July 1976. 69 p, 59 fig, 2 tab, 76 ref.

Descriptors: *Environmental effects, *Lake Michigan basin, *Reptiles, *Amphibians, *Faunal lists, *Habitats, Basins, Lakes, Checklists, Wisconsin, Michigan, Indiana, Illinois, Hiberation, Distribution, Abundance.

As part of a series of baseline assessments of the environmental status of Lake Michigan, an annotated checklist of the 25 amphibian and 35 reptilian species currently inhabiting the basin is presented, with information on regional distribution and abundance, diet, reproduction, and habitat requirements. The influence of environmental disturbances, importance of hibernation sites, and economic and ecological importance of reptiles and amphibians are discussed. Amphibian species include 11 frogs, nine salamanders, two newts, two toads, the mudpuppy, and the western lesser siren. Reptile species include 21 snakes, ten turtles, and three lizards. Fifteen habitat types by vegetation and their associated herpetofauna are described. Many ubiquitous species are found in the area in all types of vegetation. These include the American toad and eastern garter snake. Others are very specific in their habitat requirements, including the four-toed salamander, redbacked salamander, and queen snake. (Lynch-Wisconsin)
W78-05976

EUTROPHICATION IN VERMONT,
Vermont Dept. of Water Resources, Montpelier. Water Quality Div.
J. W. Morse, II, K. J. Little, and V. A. Garrison.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-267 844, Price codes: A04 in paper copy, A01 in microfiche. Water Quality Surveillance Series, Report No. 3, 1975. 69 p, 8 tab, 58 ref, 6 append.

Descriptors: *Eutrophication, *Vermont, *Lakes, *Trophic level, *Water pollution sources, Phosphorus, Nutrients, Chemcontrol, Biocontrol, Mechanical control, Lake Champlain, Algal control, Aquatic weed control, Lake stages, Waste water disposal, Nonpoint pollution, Limiting factors, Water pollution effects.

In the 287 Vermont freshwater lakes larger than 20 acres, 32.2% of the total surface area of 223,642 acres is classified as eutrophic, 32.9% as mesotrophic, 29.6% as oligotrophic, and 5.3% unclassified. Most Vermont lakes receive 42.3% of its annual phosphorus loading from point sources and 57.7% from nonpoint sources, while Lake Cahmplain receives 26.6% from point sources and 73.4% from nonpoint sources. St. Albans Bay is one of the few bodies of water receiving more

nutrients from point than nonpoint sources; eutrophication in most small lakes in Vermont is caused by nonpoint pollution. Even the Winooski River, with 17 wastewater treatment facilities, receives more than 50% of its phosphorus inputs from nonpoint sources. The drainage basins of Lakes Champlain and Memphremagog constitute 52.8% of Vermont's land area and receive effluents from 38 municipal treatment plants; Vermont's portion of Lake Champlain comprises 77% (172,032 acres) of the state's total surface area for lakes larger than 20 acres. Phosphorus is the limiting nutrient in all Vermont lakes tested. A detailed review of wastewater and plant control measures is included, with a discussion of the eutrophication process, a glossary, and statistical tables. In total there are 527 freshwater lakes in Vermont covering 225,669 acres. (Lynch-Wisconsin)
W78-05977

APPROACHES TO THE STUDY OF MICROBIAL TRANSFORMATIONS OF METALS,
National Bureau of Standards, Washington, DC.
For primary bibliographic entry see Field 5B.
W78-05978

EFFECTS OF SUBMERGED MACROPHYTES ON HELEOPLANKTONIC CLADOCERA,
Rhode Island Univ., Kingston.
T. J. Vigerstad, and L. J. Tilly.
Available from the National Technical Information Service, Springfield, VA 22161 as DP-MS-75-125, Price codes: A03 in paper copy, A01 in microfiche. In: 39th Annual Meeting of the American Society of Limnology and Oceanography, Inc, June 21-24, 1976, Savannah, GA. p 1-21. 6 fig, 1 tab, 17 ref. Report DP-MS-75-125. ERDA AI(07-2)-1.

Descriptors: *Cladocera, *Zooplankton, *Thermal pollution, *Water temperature, *Macrophytes, Submerged plants, Environmental effects, Nuclear powerplants, *South Carolina, *Par Pond(SC), Bosmina logirostris, Ceriodaphnia, Diaphanosoma brachyurum, Effluents, Predation, *Heleoplankton, Reservoirs, Fish, Ponds, Water pollution effects.

Three helioplanktonic cladocera in the littoral of Par Pond, a reservoir near Aiken, South Carolina, were sampled during July-August 1974 to study relative effects of thermal effluent from a nuclear power plant and high densities of rooted submerged macrophytes. Conclusions were that: (1) dense-rooted vegetation, perhaps providing a refuge, allows higher standing crops of Ceriodaphnia spp. and Diaphanosoma brachyurum; and (2) lower temperatures away from the thermal effluent favor Bosmina longirostris, while higher temperatures favor Ceriodaphnia spp. and D. brachyurum. The interaction of temperature and vegetation could not be determined because of nonparametric treatment of the data. To test the relative effect of the macrophytes in the thermal area, two 2 x 2 x 1 m chicken-wire exclosures were installed. One, Pen NV, was cleared of vegetation (Potamogeton pusillus and Najas guadalupensis), and the other left with the plants intact (Pen V). Total numbers were highest in Pen V, next highest in the vegetated area between the pens (Area NP), and lowest in Pen NV. The totals primarily reflected standing crop of the abundant Ceriodaphnia; the standing crop of B. longirostris was not significantly affected by either exclosure or vegetation removal, while both Ceriodaphnia and D. brachyurum were highest in Pen V (a 'pen effect'), intermediate in Area NP, and lowest in Pen NV. Reactor effluent variations during the exclosure experiment permitted study of thermal effects. (Lynch-Wisconsin)
W78-05980

EUTROPHICATION AND WATER POLLUTION,
Federal Water Pollution Control Administration, Washington, DC.
E. J. Martin, and L. W. Weinberger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-254 271, Price codes: A02 in paper copy, A01 in microfiche. In: Great Lakes Research Division, University of Michigan, Publication No. 15, p 451-469, 1966. 4 fig, 8 tab, 45 ref.

Descriptors: *Water pollution control, *Eutrophication, *Nutrients, *Waste treatment, *Nutrient removal, Waste disposal, Phosphates, Nitrates, Phosphorus, Nitrogen, Algae, Municipal wastes, Industrial wastes, Lakes, Streams, Trophic level, Nuisance algae, Oligotrophy.

The nature of accelerated eutrophication, its extent in the United States, and means of control are discussed. Naturally-occurring eutrophication may succeed oligotrophy following the birth of a lake, but increased availability of nutrient material may stimulate biological production and promote premature lake aging. Accelerated eutrophication may be defined as the state of a body of water resulting from the intentional or unintentional, natural or man-made modifications to the aquatic environment to the extent that the ecological system supports an imbalance in biological production, which creates a nuisance or interferes with water use. A discussion of nutrient characteristics is presented, and includes tables of eutrophic waters in the United States, abundance of algae in American rivers, and the most common nuisance algal species. Some human activities which increase nutrients in waters are: (1) discharge of inadequately treated sewage and industrial wastes; (2) improper agricultural and other watershed practices; and (3) canalization of streams. A detailed evaluation of eight nutrient removal systems is given: (1) activated sludge, (2) algal removal systems, (3) chemical precipitation, (4) ion exchange, (5) ammonia stripping, (6) electrodialysis and other membrane processes, (7) effluent spraying on land, and (8) distillation. Tables summarize removal rates for each process. (Lynch-Wisconsin)
W78-05982

UTAH LAKE-JORDAN RIVER BASIN MODELING PROJECT. VOLUME I. SUMMARY REPORT. VOLUME II. APPENDIX.
Environmental Dynamics Inc., Los Angeles, CA.
For primary bibliographic entry see Field 5B.
W78-05983

MUSKEGON, MICHIGAN INDUSTRIAL-MUNICIPAL WASTEWATER STORAGE LAGOONS: BIOTA AND ENVIRONMENT,
Northeast Michigan Council of Governments, Gaylord.
For primary bibliographic entry see Field 5D.
W78-05986

THE PERMISSIBLE CONCENTRATION OF LEAD IN WATER, (IN RUSSIAN),
Akademiya Nauk Turkmenskoi SSR, Ashkhabad. Inst. of Physiology and Experimental Pathology Arid Zone.
For primary bibliographic entry see Field 5G.
W78-05989

EDTA AND DTPA: THEIR EFFECT ON THE GROWTH OF BACTERIA AND ATTEMPTS TO ISOLATE BACTERIA CAPABLE OF USING THEM AS CARBON AND NITROGEN SOURCES,
Institutet for Vatten-Och Luftvardsforskning, Stockholm (Sweden).
A. Neilson, and C. Hoglund.
Swedish Water and Air Pollution Research Laboratory, Stockholm Report IVL B 349, February 1977. 16 p, 6 fig, 2 tab, 15 ref.

Descriptors: *EDTA, DTPA, *Bacteria, *Chelation, *Biodegradation, Carbon, Nitrogen, Pseudomonas aeruginosa, Assay, Pulp and paper industry, Gram-positive bacteria.

With increased use of metal chelating agents such as EDTA and DTPA by the paper industry, concern has been expressed over their possible presistence in the environment. However, none of the bacteria isolated from water and sludge samples from localities subject to inputs of these agents were capable of using them as sole carbon or nitrogen sources in pure culture. No difference between the magnesium and iron complexes was noted. Most bacteria examined were tolerant toward high concentrations (500 mg/l) of EDTA (DTPA) in the presence of 100 mg/l of magnesium (2+). As this concentration was decreased to 8 mg/l Gram-positive bacteria and Pseudomonas aeruginosa became increasingly sensitive. Although no isolated bacteria could use EDTA (DTPA) as sole carbon or nitrogen sources, it should not be concluded that microbial degradation cannot occur. Factors which must be considered include: (1) methods used may have failed to isolate the required organisms; (2) degradation may be possible only in the presence of normal substrates required for growth of the cell (co-metabolism); and (3) degradation may be achieved only by a mixed microbial population. Increasing evidence supports the prevalence of co-metabolism among less readily assimilable substrates, such as fluoroaromatic compounds and lignin, and biodegradation by mixed populations has been demonstrated with organophosphorus insecticides. (Lynch-Wisconsin)
W78-05995

RELATIVE TOXICITY IN WATER QUALITY PLANNING,
Anglian Water Authority, Huntingdon (England). Directorate of Scientific Services.
For primary bibliographic entry see Field 5G.
W78-05996

ENVIRONMENTAL INFLUENCES ON THE ACCUMULATION OF LEAD, CADMIUM, MERCURY, ANTIMONY, ARSENIC, SELENIUM, BROMINE AND TIN IN UNICELLULAR ALGAE CULTIVATED IN THAILAND AND IN GERMANY,
Gesellschaft fuer Strahlen- und Unweltforschung m.b.H., Neuherbergbei Munich (West Germany).
H. D. Payer, K. H. Runkel, P. Schramel, E. Stengel, and A. Bhumiratana.
Chemosphere, Vol. 5, No. 6, p 413-418, 1976. 5 fig, 2 tab, 14 ref.

Descriptors: *Algae, *Heavy metals, *Water pollution effects, *Water pollution sources, *Scenedesmus obliquus, *Thailand, *West Germany, Lead, Cadmium, Mercury, Antimony, Arsenic, Selenium, Bromine, Tin, Precipitation(Atmospheric), Air pollution, Fertilizers, Environmental effects, Bangkok(Thailand), Chiengmai(Thailand), Dortmund(West Germany).

Relative inputs of heavy metal to the edible chlorophyte alga Scenedesmus obliquus by various sources were determined for polluted and unpolluted environments in West Germany and Thailand. Tests conducted in 1972-73 in rural areas of Chiengmai and Bangkok, Thailand, and in agricultural areas of Dortmund, West Germany examined the role of atmospheric dust, rainfall, water quality, and fertilizers. Algae were grown outdoors under natural climatic conditions, simulating a model agricultural crop. Twice as much lead was found in algae from industrialized Bangkok than from Chiengmai, a remote rural district 700 km from Bangkok, while the lead content of algae from Dortmund was six times that of Chiengmai. Direct determination of dust fallout lead content showed that lead inputs were the results of air pollution. Superphosphate fertilizers accounted for about 50% of the cadmium, tapwater 25%, dustfall 15%, and rainwater 10%. Fertilizers were also the main source of arsenic, cadmium, selenium in

Dortmund samples, whereas tapwater was the main source of bromine, mercury, and tin, and air pollution was the primary contributor of lead and antimony. (Lynch-Wisconsin)
W78-05998

NITROGEN - AN ESSENTIAL LIFE FACTOR AND A GROWING ENVIRONMENTAL HAZARD, REPORT FROM NOBEL SYMPOSIUM NO. 38.
For primary bibliographic entry see Field 5B.
W78-05999

ALKALINE POTASSIUM PERMANGANATE DEGRADATION OF INSOLUBLE ORGANIC RESIDUES (KEROGEN) ISOLATED FROM RECENTLY-DEPOSITED ALGAL MATS,
California Univ., Berkeley. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W78-06000

THE INTERTIDAL SEDIMENT HABITATS OF THE LOWER MEDWAY ESTUARY, KENT,
Sir John Cass Coll., London (England). School of Science and Technology.
J. R. Wharfe.
Environmental Pollution, Vol. 13, No. 2, p 79-91, 1977. 6 fig, 4 tab, 16 ref.

Descriptors: *Intertidal areas, *Medway Estuary(England), *Estuaries, Habitats, *Sediments, *Benthic fauna, England, Ecology, Macroinvertebrates, Oligochaetes, Tubificids, Bioindicators, Chlorophyta, Algae, Organic matter, Oxidation-reduction potential, Particle size, Mud flats, Eutrophication, Sulfides, Ions.

Sediment cores were taken at 10 shore sampling sites in the lower Medway Estuary in Kent, England, at mid-tide level between 1973-75 during an ecological study of the benthic invertebrates macrofauna. Sediments were analyzed for particle size, redox potential profiles, total organic matter, and free sulfide ions. Supplementary data on air and water temperatures, salinity, and pH were obtained, and visual assessments were made of the percentage cover of chlorophyte algae (predominantly Entermorpha intestinalis and Ulva lactuca). In general, sites sheltered from influences of the main tidal channel (East Rainham, Bedlam Bottom, Hoo, and Damhead Creek) supported algal blooms which, upon decay, resulted in oxygen depletion in the sediment. Depletion was characterized by negative redox potentials and high organic matter and free sulfide ion levels. Populations of the tubificids Peloscolex benedeni and Hydrobia ulvae increased during these periods, and the capitellid Capitella capitata appeared. At more open sites (Motney Hill, Gallingham, Lower Upnor, and Colemouth Creek), chlorophytes were absent from the mudflats and sediments were characterized by higher redox potentials and lower organic matter and free sulfide ion levels. Nereis diversicolor was the most common phlychaete at these sites. The sediment parameters of this study proved most useful in characterizing conditions within the sediment habitats, which were not reflected in the overlying water. (Lynch-Wisconsin)
W78-06002

NITROGEN CYCLES IN A POLLUTED SEA AREA,
Tokyo Univ. (Japan). Dept. of Chemical Engineering.
H. Nishimura.
The Chemical Engineer, No. 315, p 760-764, November-December 1976. 9 fig.

Descriptors: *Seto Sea(Japan), *Nitrogen cycle, *Water pollution sources, *Oil pollution, *Organic loading, *Chemical oxygen demand, *Water pollution effects, Japan, Nutrients, Water pollution control, Oceans, Inland seas, Sediments, Benthos, Red tide, Fisheries, Fishkill, Chemical industry, Model studies, Recycling, Industrialization, Urbanization.

A model is proposed for quantitative analysis of the nitrogen cycle to determine the relative importance of two terrestrial sources of organic loading to Japan's Seto Sea. This narrow inland sea, 400 km long by 40 km wide between the mainland and Shikoku Island, is a very fertile fishing ground, but 15 years of extensive urbanization and petrochemical industrialization along its shores have resulted in severe water pollution. Oil-tainted fish, red tides, and heavy fishkills have been observed, and catches of prawn, crab, and sea bream have declined to one-third previous levels. A 1974 governmental act requires reduction of chemical oxygen demand to 60% of the 1972 level. Although the fish catch of plankton feeders (such as anchovy) has increased, a substantial decrease in benthic crustacea (prawn, crab) and benthic feeders (sea bream, turbot) is attributed to pollution of bottom sediments with organic matter. Excessive organic matter in sediments is lethal to benthic organisms as it produces sulfides in sediments while reducing sulfates in the sea water. Organic loading comes from both terrestrial sources and marine plankton. Plankton growth depends on feed rates of phosphorus and nitrogen nutrients from land; these rates are therefore nearly equivalent to the organic load in the marine environment. Thus, two sources of terrestrial organic loading are present: a direct source, in the form of organics, and an indirect source, in the form of nutrients. (Lynch-Wisconsin)
W78-06004

ABOUT THE EUTROPHICATION PROCESS OF LAKES, (IN HUNGARIAN),
Lajos Kossuth Univ., Debrecen (Hungary). Dept. of Anthropology; and Lajos Kossuth Univ., Debrecen (Hungary). Dept. of Zoology.
G. Deval, G. Kollar, and G. Ollos.
Acta Biol Debrecina 13, p 163-192, 1976.

Descriptors: *Eutrophication, *Trophic level, Decomposing organic matter, Shallow lakes, *Energy budget(Lakes), *Hungary, Nutrients, Organisms, *Photosynthesis, Regulation, Respiration, Sewage, Water pollution effects, Plant physiology.

The most important features of shallow lakes, the general character of the material and energy budget of water ecosystems, and the eutrophicational processes of shallow lakes are summarized. The role of photosynthetic production of organic material (FP) and the respiratory decomposition of organic material (RD) in the material budget of water ecosystems are discussed. The influence of the factors having the most important role in shaping the FP-RD relationship are examined. The material and energy budget of shallow waters in Hungary in extremely intensive; thus they easily reach oversaturation in nutrients, especially as a consequence of human interference causing pollution. This makes its appearance in increased trophicity. Of potential sources of nutrients causing eutrophication of shallow waters, all polluting agents must be taken into consideration, i.e., sewage, and trickling and ground water. Other inorganic plant nutrients and organic materials available for living organisms can also be sources of danger. Therefore the planning of regulations concerning water quality and the prediction of water quality should be based on these facts.--Copyright 1978, Biological Abstracts, Inc.
W78-06005

UPTAKE OF DISSOLVED AMMONIUM AND NITRATE ION BY THE FRY OF COMMON CARP, CRUCIAN CARP AND LOACH FROM SURROUNDING WATER, (IN JAPANESE),
Freshwater Fisheries Research Lab., Tokyo (Japan).
T. Ito.
Bull Freshw Fish Res Lab (Tokyo) 26(1), p 27-33, 1976.

Descriptors: *Absorption, Tracers, *Ammonium ions, *Carp, Crucian carp, Ecology, Fry, Ions, *Loach, Mineral, Nitrate ions, Trophic level, Vitamin, Water pollution effects.

Trophic relationships were studied between fish and their food organisms with the aid of 14C. 15N, instead of 14C, is preferable as a tracer for the evaluation of protein assimilation rate in fish from the view point of trophic ecology. Fish uptake various substances, such as minerals, vitamins and other molecules of minor complexity, from the environmental water. Direct absorption of dissolved nitrogenous compounds must be examined before the 15N-tracer method can be applied to the study of the trophic ecology of fish, especially in case of fry. The uptake of ammonium-15N and nitrate-15N from environmental water kept at 23-24.5 degrees C was estimated at various concentration of these substances using carp fry, crucian carp fry and loach fry. 15N was analyzed by optical spectrography after being converted into N2 gas. All of the fry showed ammonium-15N absorption directly from the water. The rate of 15-N replacement in the body N increased expotentially to the concentration of ammonia in the water as well as the time exposed to labeled ammonia for carp and crucian carp, whereas loach fry absorbed 15N more actively in linear relation and proportionally to the concentration in water. In case of nitrate-15N, less 15N was absorbed and no apparent correlation was observed between the rate of replacement and the concentration in water. When the carp fry were returned to normal water free from labeled ammonia after being exposed for 48 h, relatively large amounts of 15N were excreted within the 1st h, followed by a very slow rate of excretion. More than 50% of absorbed 15N were still retained in the body of carp after 48 h. Appreciable 15N was found in the fish killed beforehand and exposed to ammonium-15N. The amount, however, was about 1/2-1/3 that of the living carp.--Copyright 1977, Biological Abstracts, Inc.
W78-06006

NUTRIENT RELEASE FROM ANAROBIC SEDIMENTS,
Limno-Tech Inc., Ann Arbor, MI.
P. L. Freedman, and R. P. Canale.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol 103, No 2, p 233-244, April 1977. 7 fig, 1 tab, 29 ref, 2 append. EPA G005104 (Michigan) Water Resources Commission Subcontract 73-0100).

Descriptors: *Lake sediments, *Nutrients, Sediments, *Anaerobic conditions, *Nutrient flux, *White Lake(MI), Lakes, Michigan, Eutrophication, Phosphorus, Nitrogen, Ammonia, Model studies, Aquatic weeds, Algae, Municipal wastes, Industrial wastes, Sediment-water interfaces.

Anerobic sediment nutrient release in White Lake (Muskegon County, Michigan) was studied to assess the role of sediments in prolonging eutrophic conditions in lakes following sewage diversion. Field monitoring, laboratory analysis, and in-situ measurements suggest that sediments can contribute nutrients to overlying water at levels sufficient to support nuisance plant growths, thus delaying water quality improvement. Average sediment nutrient release rates were 25.1 mg P/sq m/day soluble reactive phosphorus, 38.0 mg P/sq m/day total dissolved phosphorus, and 36.2 mg N/sq m/day ammonia. The associated net diffusion coefficient across the sediment-water interface was calculated at 0.00001-0.000015 sq cm/sec. Theoretical and results for silicon release did not agree well within experimental results. A sewage-diversion spray irrigation project was implemented in the basin to divert nutrient loadings, improve water quality, excessive growths of aquatic

weeds and algae, attributed to high nutrient loadings from municipal and industrial discharges. Chlorophyll-a concentrations often exceed 40 micrograms/l and peak summer carbon uptake rates may be 100 micrograms C/cu m/hr. Average total phosphorus concentrations range from 50-75 micrograms P/l, winter nitrate and ammonia concentrations can exceed 300-400 micrograms N/l, and dissolved silicon concentrations often approach 5 mg Si/l. (Lynch-Wisconsin)
W78-06007

DIELDRIN-INDUCED DESTRUCTION OF MARINE ALGAL CELLS WITH CONCOMITANT DECREASE IN SIZE OF SURVIVORS AND THEIR PROGENY,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
C. D. Powers, R. G. Rowland, and C. F. Wurster.
Environmental Pollution, Vol 12, No 1, p 17-25, January 1977. 4 fig, 27 ref. NSF GB-11902 and BMS74-19665.

Descriptors: *Dieldrin, *Algae, *Water pollution effects, *Pesticide residues, Dinoflagellates, Exuviella baltica, Environmental effects, Pesticides, Insecticides, Phytoplankton, Pollutants, Organochlorine pesticides, DDE, Cytological studies.

Axenic cultures of the marine dionflagellate Exuviella baltica showed reduced growth and widespread cell disintegration within 12 hours of exposure to the organochlorine insecticide dieldrin at 10 parts/trillion. Surviving cells averaged 11.2% smaller than controls, and the size reduction persisted for at least four generations after transferral to a dieldrin-free medium. By contrast, DDE inhibited growth rate only. Initial cell concentrations in the experiments ranged from 3800-6400 cells/ml. Dieldrin was tested at concentrations of 0,0.1 and 10 parts/trillion growth apparently was stimulated. Mean diameter of cells from control cultures was 15.2 micrometers, compared with 13.5 micrometers for cells surviving the 10 parts/trillion treatment (a decrease of 11.2% in diameter, and 18% in cell volume and biomass). It was not determined whether dieldrin selectively ruptured the larger cells with only smaller cells surviving, or randomly affected the entire population. If a certain size class of cells were selectively affected, the availability of food for herbivores could be disturbed. The importance of cell size for copepod grazing is well-documented. Concentrations of DDE at 5 parts/trillion or higher merely inhibited growth without disrupting cells. (Lynch-Wisconsin).
W78-06011

THE EFFECT OF CHEMICAL SUBSTANCES AND THEIR COMBINATIONS ON WATER MICROFLORA, (IN RUSSIAN),
Institute of General and Municipal Hygiene, Moscow (USSR).
A. N. Zakharkina, E. A. Mozhaev, and L. E. Korsh.
Gig Sanit 3, p 108-109, 1977.

Descriptors: Potable water, *Chemical compounds, Chemical wastes, Water pollution, Acetone, *Bacteria, Coli, *Alkyl sulfates.

A series of tests were run with raw dechlorinated and sterile tap water to which was added day-old cultures of bacteria isolated from sewage to study the possibility and degree of stimulating effect of different chemical compounds on sanitary-indicative microflora and possible potentiating effects of certain combinations. The combined stimulating effect of acetone plus the liquid surfactant alkyl sulfate (AS) was greater than that of each taken separately. This potentiating effect was also noted in the combination of AS and dibasic sodium salt of monoalkylsulfosuccinic acid while AS reduced the bactericidal action of Cu. AS in concentrations of 100 mg/l and duration of contact with Escherichia coli for 6-25 days resulted in a 9% increase of biochemical changes in the bacteria, primarily, reduced capacity for gas formation.--Copyright 1978, Biological Abstracts, Inc.
W78-06014

OCEAN DUMPING: PHILADELPHIA'S STORY.
For primary bibliographic entry see Field 5E.
W78-06021

A SEARCH FOR CYTOPATHOGENIC VIRUSES IN SURFACE AND COASTAL SEA WATER IN THE PROVINCE OF PISA (ITALY), (IN ITALIAN),
Pisa Univ. (Italy). Ist. di Igine.
For primary bibliographic entry see Field 5B.
W78-06023

TEN YEARS OF WATER FLUORINATION IN IVANO-FRANKOVSK, (IN RUSSIAN),
Kievskii Meditsinskii Inst. (USSR).
For primary bibliographic entry see Field 5F.
W78-06024

HYDROGEN INPUT TO THE HUBBARD BROOK EXPERIMENTAL FOREST, NEW HAMPSHIRE, DURING LAST DECADE,
Cornell Univ., Ithaca, NY. Section of Ecology and Systematics.
For primary bibliographic entry see Field 5A.
W78-06026

SHOULD DAMS BE BUILT. THE VOLTA LAKE EXAMPLE,
United Nations Environment Program, Nairobi (Kenya).
L. Obeng.
AMBIO, Vol. 6, No. 1, p 46-51, 1977. 2 fig, 16 ref.

Descriptors: *Volta Lake(Ghana), *Dams, *Impoundments, *Environmental effects, *Multiple-purpose reservoirs, *River basin development, Ghana, Africa, Developing countries, Hydroelectric power, Planning, Lakes, Sediment load, Human diseases, Schistosomiasis, Ecology, Water storage, Water supply, Reservoirs, Aquatic weeds, Water distribution(Policy).

Environmental and societal effects of the creation of such impoundments as Volta Lake in Ghana are evaluated. Given the critical developmental importance of large dam projects for hydroelectric power and water storage in many parts of the world, dam construction is unavoidable and major attention must therefore be focused on minimizing negative effects. Volta Lake, created in 1964, is currently the world's largest fresh-water impoundment, with a shoreline of 4800 km, an area of 8500 sq km, and an estimated capacity of 165 cu km, and a depth range of 19-75 m. Primarily physical and ecological changes included: (1) the residential displacement of 80,000 persons; (2) high turbidity and greatly reduced transparency (as low as 10 cm) resulted from large quantities of suspended, dissolved, and colloidal organic matter; (3) a decreasing surface-to bottom temperature gradient and mixing of waters, with no persistent stratification; (4) low chemical ion load; (5) well-developed plankton and invertebrate populations; (6) the spread of aquatic weeds; and (7) an increase in urinary schistosomiasis. Many objectives have been met, including fisheries, water supply, irrigation, electricity production, destruction of breeding grounds of the Simulium damnosum fly, and transportation. (Lynch-Wisconsin)
W78-06033

MORTALITY OF FISH AND ENVIRONMENTAL CONDITIONS IN LAKE CHAD DURING A PERIOD OF DROUGHT, (IN FRENCH),
Office de la Recherche Scientifique et Technique Outre-Mer, N'Djamena (Chad). Centre (ORSTOM) de N'Djamena.
For primary bibliographic entry see Field 2H.
W78-06037

BACTERIAL WATER QUALITY IN WILDERNESS AREAS,
California Univ., Davis. Dept. of Engineering; and California Univ., Davis. Dept. of Environmental Science.
For primary bibliographic entry see Field 5B.
W78-06038

ALGAL ASSAY PROCEDURE BOTTLE TEST.
Pacific Northwest Water Lab., Corvallis, OR.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 419, Price codes: A05 in paper copy, A01 in microfiche. National Eutrophication Research Program, August 1971. 82 p, 5 fig, 15 tab.

Descriptors: *Bottle test, *Bioassay, *Algal assay, *Analytical techniques, *Eutrophication, *Laboratory tests, Nutrients, Bioindicators, Methodology, Algae, Water quality, Water pollution sources, Waste treatment, Limiting factors, Nutrient requirements, Pollutant identification, Water pollution effects.

The procedure described for the Bottle Test algal assay is based on Liebig's law of the minimum, or the limiting factor. In general terms, it is intended for use in: (1) determining the nutrient status of a receiving water and its sensitivity to change; (2) evaluating the potential effects of materials and products on algal growth in receiving waters; and (3) assessing effects of waste treatment process changes on receiving waters. More specifically the test can be used to: (1) identify algal growth-limiting nutrients; (2) determine biologically the availability of algal growth-limiting nutrients; and (3) quantify the biological response to changes in algal growth-limiting nutrient concentrations. Bottle algal assays consist of three steps: (1) selection and measurement of such parameters as biomass indicators; (2) presentation and statistical evaluation of measurements made during the assay; and (3) interpretation of results. The basic approach is to add selected test alga to the water, and then determine algal growth at appropriate time intervals. Procedural steps and considerations include: (1) preparation of glassware; (2) maintenance of pH below 8.5; (3) determination of maximum specific growth rate and/or maximum standing crop; and (4) biomass monitoring (related to dry weight). (Lynch-Wisconsin)
W78-06043

EFFECTS OF POLLUTION ON WATER QUALITY, PERDIDO RIVER AND BAY, ALABAMA AND FLORIDA.
Federal Water Pollution Administration, Athens, GA. Southeast Water Lab.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-253 702, Price codes: A04 in paper copy, A01 in microfiche. January 1970. 66 p, 15 fig, 6 tab, 3 append.

Descriptors: *Water pollution effects, *Perdido Bay(AL FL), *Industrial wastes, Pulp and paper industry, *Perdido River(AL FL), *Alabama, *Florida, St. Regis Paper Company, Rivers, Bays, Streams, Waste disposal, Dissolved oxygen, Organic wastes, Carbon, Effluents, Phosphates, Sewage disposal, Biochemical oxygen demand, *Pulp wastes.

Inadequately treated effluent from the St. Regis Paper is seen as the major cause of low dissolved oxygen, unsightly foam, excessive sludge deposits, and increased lignin in Perdido Bay and River (Alabama and Florida). The company, located north of Pensacola, Florida, discharges an average of 27 million gallons of pulp and bleach waste per day into Eleven Mile Creek, which flows into Perdido Bay. The waste effluent constitutes most of the dry weather flow of the creek. Water quality problems at the mouth of Bayou

Marcus are caused by discharges from six small sewage treatment plants. Dissolved oxygen in 36% of bottom waters of Perdido Bay north of Double Point and the lower mile of Perdido River is less than the 4.0 mg/l minimum set by law in Alabama and Florida. About 86% of the bottom of the bay and the lower river is covered by sludge deposits containing over 3.0% organic carbon, exercising a major oxygen demand on the overlying water. Water quality in Eleven Mile Creek is completely degraded and falls below official industrial use criteria for which the stream is classified. The St. Regis wastes account for 98% of BOD from all point sources to Perdido Bay. Recommendations for the St. Regis effluent enclude: (1) 90% removal of carbonaceous wastes, (2) removal of foam and solids, (3) reduction of color, (4) limits of 8,880 lbs/day of five-day BOD and 2,610 lbs/day total organic carbon, and (5) consideration of recirculation, treatment, and processing water reuse, (Lynch-Wisconsin)
W78-06044

BIOSTIMULATION CHARACTERISTICS OF WASTES AND RECEIVING WATERS OF THE SNAKE RIVER BASIN.
National Field Investigations Center-Denver, CO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 598, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-330/2-74-001, September 1974. 63 p, 5 fig, 16 tab, 12 ref, 2 append.

Descriptors: *Snake River Basin(Idaho), *Reservoirs, *Eutrophication, *Nutrients, *Water pollution sources, *Water pollution effects, *Idaho, American Falls Reservoir(ID), Brownlee Reservoir(ID), Milner Pool Reservoir(ID), Minidoka Reservoir(ID), Phosphorus, Algae, Nitrogen, Limiting factors, Primary productivity, Aerial photography, Waste water disposal, Agricultural runoff, Municipal wastes, Industrial wastes, Algal control, Aphanizomenon.

Algal conditions in four reservoirs on the Snake River in Idaho were evaluated during 1973-74 for stimulation by various nutrient-rich wastewater effluents. Laboratory tests complemented field data. In each reservoir--American Falls, Brownlee, Milner Pool, and Minidoka--algal bloom conditions (20 mg/l dry weight) occurred at total phosphorus concentrations of 0.1 mg/l and inorganic nitrogen levels of 1.0 mg/l. Maximum algal growth (71 mg/l dry weight) was stimulated by 1.0 mg/l total phosphorus and 10.0 mg/l inorganic nitrogen. During the summer bloom season nitrogen was the growth-limiting nutrient except in American Falls, which contained sufficient natural nutrients to sustain algal blooms. The cyanophyte Aphanizomenon was the dominant bloom alga, capable of fixing atmospheric nitrogen as a limiting nutrient. Phosphorus was the spring limiting nutrient, and was more important than nitrogen as long as cyanophyte blooms occurred. Elimination of algal blooms in the reservoirs would require reduction of total phosphorus to concentrations less than 0.1 mg/l (preferably less than 0.05 mg/l); lowering inorganic nitrogen would also be beneficial. During the summer up to 44% of nutrient load comes from agricultural sources, and blooms would not be eliminated with even a 90% reduction in nutrients from municipal and industrial sources; agricultural sources, including feedlots, must therefore be controlled. Idaho water quality standards for dissolved oxygen and nuisance plant growths are in violation in all four reservoirs. (Lynch-Wisconsin)
W78-06045

SEASONAL ABUNDANCE AND SPATIAL DISTRIBUTION OF LAKE MICHIGAN MACROBENTHOS, 1964-67.
California State Univ., Los Angeles. Dept. of Biology.
W. P. Alley, and S. C. Mozley.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 708, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-905/9-75-004, Special Report No. SR-54, Great Lakes Research Division, University of Michigan, Ann Arbor, 1975. 103 p, 30 fig, 12 tab, 49 ref, 1 append. FWPCA-WP-00311 and NSF GA-1337.

Descriptors: *Lake Michigan, *Basic data collections, *Benthic fauna, *Invertebrates, *Water pollution effects, *Eutrophication, Bioindicators, Seasonal, Distribution, Species composition, Stylodrilus heringianus, Pontoporeia affinis, Oligochaetes, Sphaeriidae, Chironomidae, Amphipoda, Insects, Ecology, Environmental effects, Sublethal effects, Water temperature, Depth.

Lakewide sampling of Lake Michigan macrozoobenthos on 16 cruises during 1964-67 indicated a rapid decline in nearshore benthic environmental quality in many areas of the southern basin. These conditions may be affecting some offshore areas as well, in spite of the persistence of such relatively sensitive species as Stylodrilus heringianus and Pontoporeia affinis. Amphipods formed 79.4% of zoobenthic dry weight, followed by oligochaetes (12.0%), sphaeriids (7.7%), and chironomids (0.9%). Biomass composition was, respectively, 87.8%, 9.1%, 2.2%, and 0.9%. No year-to year comparative differences were seen in the 15-30 meter depth interval for any taxonomic groups in terms of dry weight or biomass; within the 31-50 meter interval oligochaetes were most numerous in 1967 and biomass was greatest in 1965, but no significant yearly variations were found for dry weight or for other taxonomic groups. Below the 50 meters, amphipods were most abundant in 1965 and 1966, oligochaetes were most abundant in 1965 and 1967, chironomids were fairly consistent, and sphaeriid abundance was lowest in 1964 but increased in each succeeding year. Abundance and biomass were also influenced by upwelling and distance from shore. Average total counts, dry weight, and biomass were significantly lower in the southern basin, and the proportion of amphipods decreased while oligochaetes increased in a progression from north to south. All data are presented in tables. (Lynch-Wisconsin)
W78-06046

PHYTOPLANKTON GROWTH, DISSIPATION AND SUCCESSION IN ESTUARINE ENVIRONMENTS,
Johns Hopkins Univ., Baltimore, MD.
H. H. Seliger.
Available from the National Technical Information Service, Springfield, VA 22161 as COO-3278-35, Price codes: A02 in paper copy, A01 in microfiche. Report COO-3278-35, to Energy Research and Development Administration, April 1976. 7 p. AT911-10 3278.

Descriptors: *Phytoplankton, Ecology, *Estuarine environment, *Chesapeake Bay, Transport, *Growth rates, Estuaries, Plant growth, Prorocentrum mariae labouriae, Dinoflagellates, Bays, Measurement, Methodology, Research equipment, On-site tests, Bioassay, Eutrophication, Powerplants, Algae, Seasonal, Succession.

Two advances are reported in a study of phytoplankton ecology in Chesapeake Bay: (1) tracing of subsurface transport of a dinoflagellate for 120 nautical miles, and (2) development of a cage technique for on-site measurement of growth rates of natural mixed populations. In the lateral transport part of the study, the dinoflagellate Prorocentrum mariae labouriae was followed from the mouth of Chesapeake Bay of the vicinity of Bay Bridge via an intensive series of cruises between May 1975-April 1976. This believed to be the first direct evidence of large-scale lateral transport of an estuarine phytoplankton. Microscopic identification and counting were necessary to track Prorocentrum, which is transported and accumulated in the net northward-moving bottom waters of the bay annually between January and April. The growth rate measuring system is based on use of defined pore-size, nontoxic, minimum fouling Nucleopore filters as the cage bars. Captured phytoplankton are retained but soluble nutrient exchange across the membrane is permitted, with a half-time for exchange of less than an hour--much less than the minimum 12-hour doubling time of phytoplankton. Net growth rate is determined by microscopic counting or by chlorophyll-a assay of functions of time. This technique can be used for in-situ impact assessment of power plant heat and toxic chemical discharges. (Lynch-Wisconsin)
W78-06047

THE QUALITY OF LAKE OF THE OZARKS.
Environmental Protection Agency, Region VII, Kansas, MO.
For primary bibliographic entry see Field 5B.
W78-06050

MERCURY CONCENTRATIONS IN FISH IN LAKE OAHE, SOUTH DAKOTA, APRIL 16 TO SEPTEMBER 27, 1972.
Environmental Protection Agency, Denver, CO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 452, Price codes: A04 in paper copy, A01 in microfiche. Report SA/TSB-20, June 1973. 57 p, 13 fig, 3 tab, 12 ref, 1 append.

Descriptors: Fish, *Mercury, *Water pollution effects, *Lake Oahe(SD), *Public health, *South Dakota, Sport fish, Reservoirs, Impoundments, Toxicity, Heavy metals, Data collections, Standards.

Surveys during 1972 of sport fish in six areas of Oahe Reservoir, South Dakota showed that of 1032 fish collected, 286 (28%) had mercury levels greater than 0.5 ppm, the toxicity limit set by the FDA and EPA. Consumption of most species of sport fish from the Cheyenne Arm of the reservoir poses a threat to human health, particularly in the spring when fishing pressure is heaviest. Consumption of white bass, crappie, and sauger from Whitlock Bay could also be hazardous to health. The fish sampled were: walleye (Stizostedion vitreum vitreum), northern pike (Esox lucius), channel catfish (Ictalurus punctatus), white bass (Morone chrysops), sauger (Stizostedion canadense), black crappie (Pomoxis nigromaculatus), white crappie (P. annularis), and yellow perch (Perca flavescens). All fish were collected with sinking gill nets or frame nets. Of fish sampled from the Cheyenne Arm, 36% had mercury at or above 0.5 ppm, and fish with the highest concentrations were found in the Foster Bay (upper arm) area with 50% or more of each species containing hazardous levels during at least one sampling period. Fish from the middle and lower arms had less mercury, but both bodies of water contained fish with sufficient concentrations to represent a health hazard. Fishes from the control areas (tailrace and Lake Enemy Swim) showed small amounts of mercury. (Lynch-Wisconsin)
W78-06051

ANALYSIS OF OPERATION 'DEEP SIX' BENTHIC INVERTEBRATES.
Marine Research Inc., Falmouth, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 722, Price codes: A05 in paper copy, A01 in microfiche. Report to Environmental Protection Agency, Washington, D.C., August 1975. 83 p, 2 fig, 10 tab, 23 ref. EPA-68-01-3179.

Descriptors: *Benthic fauna, *Invertebrates, Operation deep six, *Water pollution effects, *Sludge disposal, Industrial wastes, Waste disposal, Oceans, Ocean dumping, Faunal lists, Basic data collections, Animal populations, Spe-

cies diversity, Diversity indexes, Species composition, *Delaware Bay, Environmental effects, Polychaetes, Amphipoda, Bivalvia, Operation Ides.

Sampling during 1974 of benthic invertebrates at a dumpsite for sludge and industrial wastes in ocean water of the mid-Atlantic continental shelf east of Delaware Bay showed no significant change in benthic fauna as a result of the dumping, begun in 1973. Diversity index values inside and outside the dumpsite were not significantly different, and at present no adverse effects of dumping in this area can be documented. Twenty-five stations were chosen in and around the dumpsite, located about 50 miles off the coast, and benthic samples were taken in triplicate. In the 75 samples taken, 23,043 individuals representing 194 species in 19 phyla were found. Polychaetes were most abundant, followed by amphipods and bivalves. A remarkable similarity in community composition between this study and Operation Ides (begun March 1974), conducted in the same area, was noted; 12 of 22 stations in common had the same dominant species, and nine had many of the same dominants. With respect to feeding categories, composition has not appreciably changed since the first post-dumping cruise in November 1973: deposit feeders remain high at 86%, followed by omnivores at 10.1%, carnivores at 3.3%, and suspension feeders at 0.6%. Crustacean feeders were largely absent. The study area is important because of the presence of ocean-going vessels, demersal fishing, an inshore surf clam fishery, sportfishing, and a spawning and nursing ground for several fish and invertebrate species. (Lynch-Wisconsin)
W78-06052

THE ENVIRONMENTAL IMPACT OF FRESHWATER WETLAND ALTERATIONS ON COASTAL ESTUARIES.
Georgia Dept. of Natural Resources, Atlanta. Office of Planning and Research.
Conference Report, Technical Planning Seminar, held at Savannah, Georgia on June 23, 1976. 85 p, 16 fig, 7 tab, 42 ref.

Descriptors: *Environmental effects, *Estuaries, *Freshwater-saline water interfaces, *Coastal zone management, Freshwater marshes, Wetlands, Coastal marshes, Coastal engineering, Planning, Drainage effects, Productivity, Eutrophication, Nutrients, Southeast US, Regulated flow, Model studies, Cycling nutrients, Discharge(Water), Bayous, Alteration of flow, Shoals, Channeling, Marshes, Water quality, Drainage systems, Methodology.

In order to provide a forum to review the environmental impact of freshwater wetland alterations on coastal estuaries, a coastal resource planning seminar was held June 23, 1976 at Savannah, Georgia. Seminar papers emphasized relationships observed between freshwater wetlands and estuarine values, and the use of such data for coastal planning and management. Four of the five papers are case studies about interactions between the freshwater ecosystems and estuaries. Results of the studies show that freshwater ecosystems benefit marshes and estuaries by: (1) assimilating and altering pollutants which would otherwise harm estuarine fish and wildlife; (2) regulating freshwater flow into the estuaries, and hence creating proper environmental conditions for fish and wildlife, and also preventing downstream flooding during heavy storms; (3) regulating a flow to the estuary of nutrients and other minerals, some of which are essential to the nearshore and offshore productivity. One paper is concerned with integrating scientific data into environmental planning analysis. The paper suggests application of scientific data descriptive of a system under evaluation to the alternative models designed to solve a particular planning problem. A model that maximizes the benefits and minimizes the costs to the existing ecosystem should be selected as the solution to a problem. (See also W78-06054 thru W78-06058) (Harris-Wisconsin)
W78-06053

PRODUCTIVITY AND NUTRIENT EXPORT STUDIES IN A CYPRESS SWAMP AND LAKE SYSTEM IN LOUISIANA,
Louisiana State Univ., Baton Rouge. Center for Wetland Resources.
J. W. Day, T. J. Butler, and W. H. Conner.
In: The Environmental Impact of Freshwater Wetland Alterations on Coastal Estuaries, Conference held at Savannah, Georgia on June 23, 1976. p 17-23, 1 fig.

Descriptors: *Productivity, *Cycling nutrients, *Translocation, *Estuaries, *Discharge(Water), *Bayous, Photosynthesis, *Barataria Bay(LA), Phosphorus, Nitrogen, Freshwater marshes, Carbon cycle, Sediments, Nitrates, *Louisiana.

The nutrient cycle and materials budget of the upper drainage basin of the Barataria Bay estuary, Louisiana were studied over a 14-month period in 1973-74. Carbon input from allocthonus sources plus the carbon fixed in the lake were nearly equal (within 10%) to that consumed, harvested and exported. Import of total nitrogen into the lake was 1.9 times greater than export, while import of phosphorus was 1.8 greater than export. Activity in the sediment (nitrate stored and/or denitrified and phosphorus adsorbed to the clay sediments) probably account for these differences. Export of materials from the wetland watershed into the lake equaled 19.3 g C per sq m per year, 2.7 g N per sq m per year, and 0.39 g P per sq m per year. Within the freshwater wetland system water serves as a vehicle for waste removal and nutrient supply. Sediments function in removal and storage of large amounts of phosphorus and nitrogen and thus represent a buffer that slows lake eutrophication. The freshwater wetland system is functionally interconnected with the estuary. It supplies it with nitrogen, phosphorus, carbon, and organic nutrients. It also serves as a nursery for the estuarine fish species. Therefore in any coastal management program the dependence between freshwater wetlands and estuary should be considered. (See also W78-06053) (Harris-Wisconsin)
W78-06054

CASE STUDY: THE SANTEE RIVER, S.C.,
South Carolina Univ., Columbia.
B. Kjerfve.
In: The Environmental Impact of Freshwater Wetland Alterations on Coastal Estuaries, Conference held at Savannah, Georgia on June 23, 1976. p 25-31, 2 fig, 2 ref.

Descriptors: *Alteration of flow, *Santee River(SC), *Environmental effects, *Shoals, Discharge(Water), Salinity, Circulation, Sediment transport, Deposition(Sediments), Coastal engineering, Accelerated erosion, Vegetation effects, Water pollution effects, Shellfish farming, Cooling water, Industrial water, Dredging, Wildlife habitats, Ducks(Wild), Hydroelectric power, *South Carolina.

The Santee River with an annual mean discharge of 525 cu m/sec was the fourth largest river on the east U.S. coast prior to 1942. In that year most of the Santee's flow was diverted into the tidally-dominated Cooper River by construction of dams at Wilson's landing and Pinopolis and the creation of Lakes Marion and Moultrie. The Santee's main discharge was thereby lowered to 62 cu m/sec. Conversely, the discharge of the Cooper River experienced an increase from 2 to 422 cu m/sec. Other non-desirable effects of the 1942 diversion project were: (1) a drastic increase in salinity of the lower Santee and a decrease of the Cooper River salinity (from 31 to 16 ppt measured 8 km from the mouth); (2) a return of salty water by way of bottom layers of the Cooper River; (3) transport of sand into Charleston Harbor from the ocean; (4) settling of fine sediments throughout the estuary; (5) erosion of barrier islands and spits in the vicinity of the Santee's mouth; (6) replacement of hardwoods along the lower Santee by grasses. Desirable effects were: (1) a decrease of water pollution in the Cooper; (2) availability of water from the Cooper for processing industrial requirements; (3) increased shellfish harvest in the lower Santee; (4) supply of 1.52% of the State's total electrical power. Dredging costs prompted the 1975 decision to redivert 80% of the Cooper flow back to the Santee via a proposed rediversion canal at the cost of $100 million. However, the same result could be accomplished at the fraction of the proposed cost by opening a spillway at Wilson Landing and letting the Santee return to prediversion conditions with time. (See also W78-06053) (Harris-Wisconsin)
W78-06055

OBSERVATION ON PRODUCTIVITY OF SWAMP STREAMS IN EASTERN NORTH CAROLINA,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
E. J. Kuenzler.
In: The Environmental Impact of Freshwater Wetland Alterations on Coastal Estuaries, Conference held at Savannah, Georgia on June 23, 1976. p 34-45, 2 fig, 3 tab, 10 ref.

Descriptors: *Productivity, *Environmental effects, *Channeling, *Marshes, *Water quality, Atlantic Coastal Plain Province(NC), Conetoe Creek(NC), Creeping Swamp(NC), Palmetto Swamp(NC), Chicod Creek(NC), Tracy Swamp(NC), Grindle Creek(NC), *North Carolina.

Monthly discharge, water conductivity, color, turbidity, nitrate concentrations and contributions of organic matter in six small streams situated in the Atlantic Coastal Plain province in North Carolina were measured as part of a study on the functioning of natural swamp streams in relation to possible impact of swamp alterations on the downstream estuaries. Results of the experiments indicate at least six important ways in which natural bottomland swamp systems may influence estuaries in a manner generally considered desirable. Natural swamps: (1) decrease the impact of freshwater floods upon the salinity structure of the estuary; (2) decrease the amount of silt which otherwise would adversely affect oysters and shipping; (3) control eutrophication of the lower river and upper estuary; (4) reduce the level of individual wastes and pesticides in estuarine waters; (5) provide nursery grounds for anadromous fishes; and (6) export substantial amounts of organic matter to the estuary where some of it finds its way into fish and shellfish harvests. (See also W78-06053) (Harris-Wisconsin)
W78-06056

HYDROLOGIC AND ENVIRONMENTAL EFFECTS OF A LONG-TERM DRAINAGE ON A COASTAL AREA, (CASE STUDY: MELBOURNE TILLMAN DRAINAGE DISTRICT, PALM BAY, FLORIDA),
Florida Inst. of Tech., Melbourne. Center for Coastal Zone Research.
For primary bibliographic entry see Field 2L.
W78-06057

INTEGRATING SCIENTIFIC DATA INTO ENVIRONMENTAL PLANNING AND IMPACT ANALYSIS, GENERAL METHODOLOGY AND A CASE STUDY,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 6G.
W78-06058

EFFECTS OF TEMPERATURE ON AQUATIC ORGANISM SENSITIVITY TO SELECTED CHEMICALS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
J. Cairns, Jr., A. L. Buikema, A. G. Heath, and B. C. Parker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 763, Price codes: A05 in paper copy, A01 in microfiche. Virginia Water Resources Research Center, Blacksburg, Bulletin 106, February 1978, (VPI-WVRRC-BULL 106). 88p, 20 tab, 15 fig, 103 ref. OWRT B-084-VA(1).

Descriptors: *Toxicity, *Water pollution effects, Algae, Zooplankton, *Bioassay, Benthos, Fish, *Chemicals, Copper, Zinc, *Thermal pollution, Chromate, Chlorine, Cyanide, Phenols, *Food webs, Invertebrates, Oligochates, Aeolosoma, *Toxicants, Aquatic organisms.

This research evaluates the effect of temperature on the sensitivity of food web oganisms to selected chemicals. Test organisms included plantonic algae, zooplankton, microbenthos, macrobenthos, and fishes. The chemicals used were copper, zinc, chromate, chlorine, cyanide, and phenol. The sensitivity of the test organisms to these chemicals was studied over a temperature range of 5 deg to 35 deg C. The specific temperatures studied was studied with each species. Results indicate considerable variation in the sensitivity of each species, depending on the chemical and the test temperature. Generally, the algal responses to the temperature and chemicals varied depending on the thermal sensitivity of the algal species in question. The invertebrates usually exhibited the classic response of increased sensitivity to chemicals at higher temperatures. Two notable exceptions were the 'reverse' response to temperature and cyanide of the oligochaete Aeolosoma and the temperature-independent response of the invertebrates to phenol. For fish, survival was enhanced (a) at low concentrations of chemicals and high temperatures and (b) at high chemical concentrations and low temperatures. Some fish species had chemical threshold concentrations which were not influenced by temperature.
W78-06063

EFFECTS OF SILT AND TURBIDITY FROM AGRICULTURAL DRAINAGE ON BENTHIC INVERTEBRATES IN STREAMS IN WESTERN MINNESOTA,
Minnesota Univ., St. Paul. Dept. of Entomology, Fisheries and Wildlife.
For primary bibliographic entry see Field 4D.
W78-06065

EFFECTS OF STREAM CHANNELIZATION ON FISH POPULATIONS IN THE BUENA VISTA MARSH, PORTAGE COUNTY, WISCONSIN,
Wisconsin Cooperative Fishery Research Unit, Stevens Point.
M. R. Headrick.
Prepared for Stream Alteration Project, Office of Biological Services, Fish and Wildlife Service, September, 1976. 38 p, 4 fig, 17 tab, 40 ref, 1 append.

Descriptors: *Ditches, *Channeling, *Stream fisheries, *Brook trout, Fish, Suckers, Sculpins, *Wisconsin, Productivity, Water temperature, Spoil banks, *Marshes, *Buena Vista Marsh(Wis), Instream cover, Angler success.

Fish populations from ditches 6-8 years old and 52-62 years old were compared with populations in adjacent portions of natural streams. Two study areas were selected: an upstream zone of good brook trout habitat and a downstream zone of marginal trout habitat. Loss of year-round instream cover through channelization limited brook trout density, which reduced annual brook trout production to 28.8 kg/ stream km in the upstream new ditch compared to 72.2 kg/km and 65.5 km/km in the upstream old ditch and the upstream natural stream, respectively. Angler success was also reduced in the upstream new ditch. Midsummer water temperatures reached upper lethal levels for brook trout in the downstream ditches where current velocity was reduced and white sucker abundant. Mottled sculpin were consistently absent from the upstream new ditch and scarce in the downstream new ditch. The natural stream had the greatest number of fish species in both study areas; the new ditch had the fewest species. Recovery was more rapid in ditches where spoil was spread on adjacent fields and bank vegetation left in place than where spoil was left on the banks. (Stihler-Mass)
W78-06090

BACTERIAL VARIATIONS IN STREAMS FROM A SOUTHWEST IDAHO RANGELAND WATERSHED,
Agricultural Research Service, Boise, ID. Northwest Watershed Research Center.
For primary bibliographic entry see Field 5B.
W78-06116

AN ECOLOGICAL MODEL FOR LAKE ONTARIO MODEL FORMULATION, CALIBRATION, AND PRELIMINARY EVALUATION,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 2H.
W78-06119

HIGHWAY OPERATION AND PLANT DAMAGE-DATA APPENDIX (SOIL CHEMISTRY, SALT APPLICATION, OZONE, PRECIPITATION),
California State Dept. of Transportation, Sacramento. Transportation Lab.
For primary bibliographic entry see Field 4C.
W78-06131

HERBICIDE REPORT: CHEMISTRY AND ANALYSIS, ENVIRONMENTAL EFFECTS, AGRICULTURAL AND OTHER APPLIED USES.
Environmental Protection Agency, Washington, D.C. Hazardous Materials Advisory Committee.
For primary bibliographic entry see Field 5A.
W78-06133

I. DYNAMICS OF MERCURY IN LAKE SEDIMENTS. II. STUDIES ON ORGANIC PHOSPHORUS IN SOILS IRRIGATED WITH MUNICIPAL WASTEWATERS,
Purdue Univ., Lafayette, IN.
M. Floyd.
Available from University Microfilms International, Ann Arbor, Michigan 48106; Order No 77-15, 404. PhD Thesis, 1976, 103 p.

Descriptors: *Mercury, *Soils, *Phosphorus, *Waste water disposal, *Irrigation practices, *Chemical reactions, Municipal wastes, Humic acids, Phosphorus compounds, Analytical techniques, Polymers, Alkylmercury, Phosphotase.

The synthesis and degradation of alkylmercury compounds in sediments, the effects of municipal waste water irrigation on the levels of phosphotase in soils, and the stability of organic phosphorus compounds in humic polymers were examined in laboratory experiments. Studies indicated that mercury was not significantly transformed in sediments, and that microbial activity was necessary for the degradation of alkylmercury compounds in natural sediments. Studies with waste water irrigated soils revealed that phosphotase activity was dependent on the crop grown and based on the following relationship: reed canary grass > hardwood forest on clay loam > old field > hardwood forest on sandy loam > corn. (Schulz-FIRL)
W78-06137

SEWAGE SLUDGE-SOIL SYSTEMS: A STUDY OF METAL FORMS AND EFFECT OF METALS ON CARBON AND NITROGEN TRANSFORMATIONS,
Purdue Univ., Lafayette, IN.
D. J. Silviera.
Available from University Microfilms International, Ann Arbor, Michigan 48106; Order No 77-15, 470. PhD Thesis, 1976, 106 p.

Descriptors: *Heavy metals, *Solvent extractions, *Mineralogy, *Soils, *Soil chemical properties, X-ray diffraction, Sludge disposal, Chemical analysis, Copper, Zinc, Lead, Cadmium, Nickel, Nitrification, Environmental effects, Waste water disposal, Diethylenetriamine-pentaacetic acid, Synthetic sludge, Metals-soils relationships.

The fate and distribution of heavy metals, including Cu, Zn, Cd, Pb, and Ni, were investigated for sewage sludge and soils amended with sewage sludge. X-ray diffraction analyses of sludge from six Indiana cities revealed that quartz, feldspar, montmorillonite, chlorite, mica, dolomite, and calcite were present in crystalline form. DTPA (diethylenetriamine-pentaacetic acid) extractibility was used in studies on the effect of soil, sludge, and environmental factors on the distribution of sludge-borne heavy metals. Metal movement through soils was reduced during frequent applications of small amounts of sludge relative to larger, more infrequent applications and was observed to be at its lowest level when sludge was applied at a rate of 22.4 metric tons/ha. The extraction of metals with DTPA was reduced under anaerobic conditions. In studies with synthetic sludge, the DTPA extractabilities of Cu, Zn, Pb, and Ni were altered by the presence of sludge organic matter while Cd was unaffected. In studies on the interaction of Cu, Zn, Cd, Pb, and Ni with C and N transformations, high heavy metal concentrations were reported to reduce nitrification by as much as 50%. The reasonable agreement of data obtained in studies with municipal and synthetic sludges has led to the suggestion that synthetic sludges be used in studies on soils-microbes-metals relationships. (Schulz-FIRL)
W78-06139

AERATION/CIRCULATION KEEPS ALGAL BLOOMS IN CHECK,
Tetra Tech, Inc., Lafayette, CA.
For primary bibliographic entry see Field 5G.
W78-06140

DISSOLVED ORGANIC MATTER AND LAKE METABOLISM,
Michigan State Univ., Hickory Corners. W. K. Kellogg Gull Lake Labs.
R. G. Wetzel.
Available from the National Technical Information Service, Springfield, VA 22161 as COO-1599-104P1, Price codes: A03 in paper copy, A01 in microfiche. Technical Progress Report, COO-1599-104 (Part 1), Prepared for Energy Research and Development Administration, Argonne, Illinois. 47 p, 1 fig, 94 ref. (1977). ERDA E(11-1)-1999.

Descriptors: *Organic matter, *Metabolism, *Lakes, *Dissolved organic matter, *Eutrophication, Lawrence Lake(MI), Michigan, Trophic level, Oligotrophy, Nutrients, Algae, Macrophytes, Limiting factors, Carbon, Phytoplankton, Photosynthesis, Nutrient flux.

An interim report covers 12 months (1975-76) of study on interactions of dissolved organic matter with inorganic nutrient cycling and regulation of the photosynthetic and decompositional metabolism of microflora and macroflora. Major efforts cover: (1) sources, fates, pathways, and interactions of dissolved organic matter in inorganic

chemical cycling; (2) allochthonous sources, metabolism en route, and inputs to the lake systems of increasing stages of eutrophication; and (3) relationships of these compounds to the nutrient physiology and metabolism of phytoplankton, sessile algae, macrophytes, and bacterial populations. Analyses of regulatory mechanisms of growth and rates of carbon cycling center on evaluation of quantitative control interactions among: (1) microflora of the pelagic zones of several lakes of progressively greater eutrophication; (2) littoral photosynthetic producer-decomposer complex; and (3) allochthonous inorganic-organic influxes and their biotic processing. The underlying thesis of the project is that quantification of the dynamic carbon fluxes among these components and their rate control mechanisms are necessary to clarify the rate functions of lake eutrophication. Most current research is directed towards the fate and mechanisms regulating utilization and losses of organic carbon. Integrated research activities have concentrated on oligotrophic Lawrence Lake, Michigan. (Lynch-Wisconsin)
W78-06142

SODIUM BICARBONATE, AN INEXPENSIVE FISH ANESTHETIC FOR FIELD USE,
Wisconsin Cooperative Fishery Research Unit, Stevens Point.
H. E. Booke, B. Hollender, and G. Lutterbie.
The Progressive Fish Culturist, Vol. 40, No. 1, p 11-13, 1978. 1 tab, 8 ref.

Descriptors: *Sodium, *Carbon dioxide, Rainbow trout, *Toxicity, *Public health, *Sodium compounds, Fish physiology, *Animal metabolism, Brook trout, Carp, *Hydrogen ion concentration, *Bicarbonates, *Anesthetics(Fish), Buffers.

Sodium bicarbonate was tested as a fish anesthetic at combinations of 142 to 642 mg/l, pH 6.5 to 7.5, with rainbow trout (Salmo gairdneri), brook trout (Salvelinus fontinalis), and carp (Cyprinus carpio). The combination of pH 6.5 and 642 mg/l sodium bicarbonate was the most effective treatment for causing fish, within 5 min, to cease locomotion and slow opercular rate, but to retain reflex response to pressure on the caudal fin. We suggest that pH-controlled carbon dioxide release from the sodium bicarbonate caused the anesthetic response. (Dael-EIS)
W78-06143

SUBLETHAL EFFECTS OF OIL ON MOLLUSC SPECIES FROM THE BALTIC SEA,
Swedish Water and Air Pollution Research Lab., Nykoping.
O. Linden.
Water, Air, and Soil Pollution, Vol. 8, No. 3, p 305-314, 1977. 3 fig, 30 ref.

Descriptors: *Animal metabolism, *Reproduction, *Oil spills, *Oil pollution, *Toxicity, *Mollusks, *Mussels, *Snails, Animal behavior, Spectrophotometry, Water pollution effects, Baltic Sea, *Crude oil, *Bivalves, *Macoma, *Theodoxus.

Sublethal effects of Iranian crude oil were studied using molluscs from the brackish Baltic Sea. In blue mussels (Mytilus edulis) low concentrations caused a reduction in byssal attachment. The sensitivity of the mussels appeared to increase with increasing size. The burrowing behavior of the bivalve Macoma baltica was found to be affected at oil concentrations of 70 micrograms l-1. Also small individuals appeared less sensitive to the oil than large ones. The effect of oil on the crawling rate of the snail Theodoxus fluviatilis was studied. Low concentrations apparently increased the rate of crawling initially while at the end of exposure time the activity decreased. At higher concentrations the crawling rate was very low throughout the experimental period and stress symptoms like complete immobolization occurred. (Dael-EIS)
W78-06144

ACID PRECIPITATION AND REPRODUCTIVE SUCCESS OF AMBYSTOMA SALAMANDERS,
Cornell Univ., Ithaca, NY. Section of Ecology and Systematics.
F. H. Pough, and R. E. Wilson.
Water, Air, and Soil Pollution, Vol. 7, No. 3, p 307-316, 1977. 3 fig, 1 tab, 25 ref.

Descriptors: *Salamanders, *Reproduction, Animal physiology, *Chemical precipitation, *Acidic water, *Acidity, Mortality, *Toxicity, Populations, *Growth stages, Animal behavior, *Embryonic growth stage, *Larval growth stage, Hydrogen ion concentration, Water temperature, *Ambystoma.

The two species of mole salamander that occur in the Ithaca, New York, region (Ambystoma jeffersonianum and A. maculatum) breed in temporary ponds that are formed by accumulation of melted snow and spring rains. Water in many of these ponds during the breeding season is acid; pH values as low as 3.5 have been measured. In laboratory experiments, A. maculatum tolerated pHs 4 to 8 and was most successful at pH 5 to 6. Mortality rose abruptly beyond the tolerance limits. The pH optimum shifted upward with increasing temperature for A. jeffersonianum and downward for A. maculatum. (Dael-EIS)
W78-06145

ORGANOCHLORINE RESIDUES IN NEW JERSEY OSPREY EGGS,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
For primary bibliographic entry see Field 5A.
W78-06150

METAL TOXICITY TO EMBRYOS AND LARVAE OF SEVEN FRESHWATER FISH SPECIES - I. CADMIUM,
Environmental Research Lab.-Duluth, MN.
J. G. Eaton, J. M. McKim, and G. W. Holcombe.
Bulletin of Environmental Contamination and Toxicology, Vol. 19, No. 1, 1978, p 95-103. 3 tab, 11 ref.

Descriptors: *Cadmium, *Metals, Toxicity, Bioassay, *Freshwater fish, Juvenile fish, Larvae, Laboratory tests, Methodology, Brook trout, Brown trout, Lake trout, Pikes, Bass, Salmon, Suckers, *Water pollution effects, Coho salmon, Smallmouth bass.

The embryos and larvae of seven freshwater fish were exposed to low concentrations of cadmium in soft water. All species were killed or their growth retarded by concentrations ranging from about 4 to 12 micrograms Cd/liter. The larvae were consistently more sensitive than the embryos. The agreement between these results and those from life-cycle chronic toxicity studies indicates that embryo and larval exposures will give reliable estimates of the chronic toxicity of cadmium to additional fish species. a 60-day exposure period appears to be appropriate for determining larval sensivity to cadmium. (Katz-EIS)
W78-06151

THE ACUTE AND CHRONIC EFFECTS OF CADMIUM ON THE ESTUARINE MYSID MYSIDOPSIS BAHIA,
Environmental Research Lab., Gulf Breeze, FL.
D. R. Nimmo, R. A. Rigby, L. H. Bahner, and J. M. Sheppard.
Bulletin of Environmental Contamination and Toxicology, Vol. 19, No. 1, 1978, p 80-85. 2 tab, 16 ref.

Descriptors: *Bioassay, Metals, *Cadmium, *Toxicity, Methodology, *Zooplankton, *Crustacea, Water pollution effects, Laboratory tests, Laboratory animals, Pollutant identification, *Acute toxicity, Chronic toxicity, *Mysids, Mysidopsis bahia, LC50.

Mysids, small shrimp-like crustacea, proved to be a practical bioassay animal for investigating the effects of cadmium in seawater and may serve this purpose for other pollutants. In the laboratory under flow-through test conditions, the mysid, Mysidopsis bahia, was more sensitive to cadmium than other crustaceans tested. LC50 values were 15.5 micrograms/l within 96 hrs and 11.3 micrograms/l during a 17-day life cycle, whereas LC50's for other selected crustaceans were between 120 and 720 micrograms/l. Results of life-cycle bioassays can aid in the establishment of water quality criteria for marine and estuarine organisms. (Katz-EIS)
W78-06152

SURVIVAL OF STEELHEAD TROUT (SALMO GAIRDNERI) EGGS, EMBRYOS, AND FRY IN AIR-SUPERSATURATED WATER,
Environmental Protection Agency, Corvallis, OR.
A. V. Nebeker, J. D. Andros, J. K. McCrady, and D. G. Stevens.
Journal of the Fisheries Research Board of Canada, Vol. 35, 1978, p 261-264. 1 fig, 2 tab, 8 ref.

Descriptors: Bioassay, *Rainbow trout, *Mortality, *Fish eggs, Juvenile fish, *Supersaturation, Methodology, Laboratory test, *Aquiculture, Water temperature, Growth stages, Fish diseases, *Air supersaturation, *Gas supersaturation, *Steelhead trout, Fish embryos, Yolk-sac stages, *Gas bubble disease.

Eggs, embryo, fry, and swim-up stages of steelhead trout (Salmo gairdneri) were exposed to water at total gas saturation levels ranging from 130 to 115%. Eggs, embryos, and newly hatched fry were not affected at 126.7%, but at about day 16 posthatch when the fish began swimming up deaths occurred rapidly, and at the end of the test post button-up mortality ranged from 99% at 126.7% saturation to 45% at 115.3% saturation. Bubbles in the mouth, gill cavity, and yolk sac caused flotation and severe respiratory difficulties. Rupture of yolk-sac membranes also caused death. No differences were noted in survival between fish exposed from egg to fry, and those exposed only from swim-up to fry stage. In summary, there were differences in susceptibility among steelhead life stages to air-supersaturated water; eggs, embryos, and pre-swim-up larvae were more resistant than swim-up and later fry stages. (Katz-EIS)
W78-06153

BENTHOS OF AN ACID LAKE,
Uppsala Univ. (Sweden). Dept. of Entomology.
T. Wiederholm, and L. Eriksson.
Oikos, Vol. 29, 1977. p 261-267. 3 tab, 3 fig, 13 ref.

Descriptors: *Benthos, *Hydrogen ion concentration, *Acidic water, Acidity, Acids, Lakes, *Animal populations, Aquatic insects, Limnology, On-site investigations, Oligotrophy, Polyhumic lakes, *Chironomids, *Lake Trestickeln(Sweden).

Data on composition and distribution of the bottom fauna in a very acid lake (pH 3.9-4.6) in western Sweden are reported. In comparison with three other lakes with higher pH values the fauna is low in abundance with few taxa represented. The benthos is most similar to that of a typically polyhumic reference lake. Molluscs and large crustaceans are missing but many chironomid species show little or no reduction in their distribution. (Katz-EIS)
W78-06154

TWO ANOMALIES OF FISH LARVAL TRANSPORT AND THEIR IMPORTANCE IN ENVIRONMENTAL ASSESSMENT,
Power Authority of the State of New York.
D. N. Wallace.
New York Fish and Game Journal, Vol. 25, No. 1, p 59-71, 1978. 8 fig, 2 tab, 8 ref.

Descriptors: *Entrainment, *Larval growth stage, *Fish populations, *Intakes, *Intake structures, *Electric powerplants, *Larvae, *Striped bass, *Fish behavior, *Cooling towers, *Cooling water, *Currents(Water), Environmental effects, Hudson River, *Entrainment impact.

Environmental impact assessments for industrial plants using water generally include estimates of ichthyoplankton entrainment. The pattern of transport of fish larvae in water currents determines the proportion of a population which will pass through the zone of intake influence and the proportion of those passing the intake which will be entrained. Sampling studies revealed two anomalies of importance to such estimates: (1) data from field surveys in the Hudson River estuary showed that larvae are not transported in the water mass like solute particles; and (2) data from entrainment monitoring at generating plants on the Great Lakes showed that larval densities in the entrained water are not always the same as those in the surrounding ambient water. Realistic assessment of entrainment impact is both environmentally and economically important, and laboratory observation of the conditions that determine patterns of larval transport would be desirable. (Dael-EIS)
W78-06155

ROTENONE TOLERANCES OF STREAM-BOTTOM INSECTS,
New York State Dept. of Environmental Conservation, Livingston Manor. DeBruce Inland Fisheries Lab.
R. Engstrom-Heg, R. T. Colesante, and E. Silco.
New York Fish and Game Journal, Vol. 25, No. 1, p 31-41, 1978. 1 fig, 3 tab, 15 ref.

Descriptors: *Insects, *Insecticides, *Rotenone, *Piscicides, *Pesticides, *Fish control agents, Fish stocking, *Fish food organisms, *Oxygen requirements, Resistance, *Toxicity, Mortality, Fish populations, *Respiration, Caddisflies, *Mayflies, Benthos.

Stream-bottom insects varied greatly in their tolerance to rotenone. Tolerances did not adhere closely to taxonomic lines, but showed a possible relationship to oxygen requirements. The more sensitive genera tended to have short life cycles, high mobility and a potential for rapid repopulation. In many streams an exposure of 5 per cent emulsifiable rotenone formulation would eliminate undesired fish with only mild and temporary damage to the bottom fauna. Very few immature aquatic insects could survive a 48-hour exposure to 3 ppm of 5 per cent formulation. (Dael-EIS)
W78-06156

INHIBITORY EFFECTS OF COPPER ON MARINE DINOFLAGELLATES,
Biologische Anstalt Helgoland (West Germany). Meeresstation.
S. M. Saifullah.
Marine Biology, Vol. 44, p 299-308, 1978. 5 fig, 1 tab, 28 ref.

Descriptors: *Copper, *Toxicity, *Growth rates, *Dinoflagellates, *Gymnodinium, *Chlorophyll, Inhibitors, *Tracers, *Radioactivity techniques, *Photosynthesis, Mortality, Path of pollutants, Cytological studies, Aquatic microorganisms, Metabolism, *Scrippsiella, *Prorocentrum.

The effects of copper on three species of marine dinoflagellates was studied. It inhibited the growth of all species and was lethal to one species in batch cultures. The effect was more pronounced in semicontinuous culture than in batch cultures. Chlorophyll concentrations and rate of uptake of radioactive carbon by cells of Scrippsiella faeroense were affected in a manner similar to cell numbers. Copper inhibited growth of cells, most probably either by arresting cell division or by penetrating inside the cell and affecting metabolism. (Dael-EIS)
W78-06157

THE RESIDUE UP TAKE AND HISTOLOGY OF AMERICAN OYSTERS (CRASSOSTREA VIRGINICA GMELIN) EXPOSED TO DIELDRIN,
Mote Marine Lab., Sarasota, FL.
M. Emanuelsen, J. L. Lincer, and E. Rifkin.
Bulletin of Environmental Contamination and Toxicology, Vol. 19, No. 1, 1978, p 121-129. 3 tab, 3 fig, 14 ref.

Descriptors: *Dieldrin, *Oysters, *Chlorinated hydrocarbon pesticide, Bioassay, Toxicity, Laboratory tests, Florida, Gas chromatography, Commercial shellfish, *Absorption, *Animal physiology, Pathology, Water pollution effects, *American oysters, Histopathology, Histochemistry.

The results reported herein strongly suggest that relatively short-term exposures of low levels of dieldrin do not cause histopathological damage to C. virginica. It was found that C. virginica, after a 43-day exposure to 3 levels of dieldrin, concentrated approximately 5 x 10 to the 3rd power times (based on OD weight of tissue) the level of contaminant found in the water, regardless of its nominal concentration. The percent lipid was found to vary directly with the concentration of pesticide in the water. (Katz-EIS)
W78-06158

MOVEMENT OF BENTHOS DURING THE RECOLONIZATION OF TEMPORARY STREAMS,
Toronto Univ. (Ontario). Div. of Life Sciences.
D. D. Williams.
Oikos, Vol. 29, 1977, p 306-312, 2 tab, 5 fig, 7 ref.

Descriptors: *Benthos, *Invertebrates, Animal groupings, Animal populations, *Temporary pond stage, *Drifting(Aquatic), *Aquatic insects, Migration, Migration paths, On-site investigation, Methodology, Ephemeral streams, *Temporary streams, *Recolonizers, Substrate, Ontario, Canada, Upstream migration, Vertical migration, Aerial migration.

The relative importance of each of four main sources of animals is examined experimentally during the annual repopulation of two temporary streams. The sources are: drift, and upstream migration from pools, migration from within the substrate, and aerial sources. Animals which have spent the summer drought as dormant forms buried in the substrate are the most important recolonizers, although isolated pools may also act as faunal refuges. Drift provides an effective means of dispersing clumped individuals at the start of each new lotic phase, and upstream migration is also prevalent at this time. (Katz-EIS)
W78-06159

TROUT HEPATIC ENZYME ACTIVATION OF AFLATOXIN B1 IN A MUTAGEN ASSAY SYSTEM AND THE INHIBITORY EFFECT OF PCBS,
Oregon State Univ., Corvallis. Dept. of Food Science and Technology.
W. T. Stott, and R. O. Sinnhuber.
Bulletin of Environmental Contamination and Toxicology, Vol. 19, No. 1, 1978, p 35-47. 2 fig, 22 ref.

Descriptors: *Fish diseases, Fish physiology, Rainbow trout, *Polychlorinated biphenyls, Laboratory tests, Methodology, *Water pollution effects, Laboratory devices, Enzymes, Animal biochemistry, Pathology, *Aflotoxins, *Aroclor 1254, Bacterial Mutagen Assay Systems, Mutagen Assay Response.

In summary, it was demonstrated that the trout post mitochordrial fraction successfully employed in the Ames mutagen assay method by utilization of proper salts solution and a metabolic preincubation period at 25C. It has also been observed that, unlike the rat, pretreatment of rainbow trout with various PCBs decrease the mutagen assay response to aflatoxin B. (Katz-EIS)
W78-06160

THE FATE OF FENITROTHION IN AN AQUATIC ECOSYSTEM,
Ottawa Univ. (Ontario). Dept. of Biology.
R. P. Moody, L. Greenhalgh, L. Lockhart, and P. Weinberger.
Bulletin of Environmental Contamination and Toxicology, Vol. 19, No. 1, 1978, p 8-14. 1 fig, 2 tab, 11 ref.

Descriptors: *Insecticides, *Gas chromatography, On-site investigation, Methodology, *Phosphothioate, Pesticides, Algae, Phytoplankton, *Degradation(Decomposition), Aquatic plants, Water pollution effects, Path of pollutants, Canada, *Fenitrothion, *Aminofenitrothion, Duckweed, Lemna minor, Hornwort, Ceratophyllum demersum, Flowering rush, Metabolites.

Fenitrothion, an insecticide used in Canada, has been shown to persist in aquatic vegetation. Duckweed have been observed to pick up fenitrothion within 10 hours after application. A strong partition of fenitrothion in the water may be due to adsorption of the particulate matter but may be indicative of active uptake by unicellular algae. (Katz-EIS)
W78-06161

PHOTOTACTIC AND THERMOTACTIC RESPONSES FACILITATING SURVIVAL OF CLOEON DIPTERUM (EPHEMEROPTERA) LARVAE UNDER WINTER ANOXIA,
Uppsala Univ. (Sweden). Inst. of Zoophysiology.
B. Nagell.
Oikos, Vol. 29, 1977, p 342-347. 1 tab, 5 fig, 6 ref.

Descriptors: Ponds, *Aquatic insects, *Benthos, *Oxygen, Freezing, Ice, Ice cover, Water temperature, Animal behavior, Animal metabolism, Light intensity, Light penetration, Juvenile growth stage, *Mayflies, *Ephemeroptera, Cloeon dipterum, *Winter anoxia, Phototactic responses, Thermotactic responses.

About 10 d after the freezing up of a pond, and coincident with the total water-body becoming anoxic, larvae of Cloeon dipterum L. were observed to suddenly migrate to the underside of the ice. Larvae remained there for the winter. Laboratory experiments were performed to examine the factors responsible for causing this migration. In aeration water larvae, acclimated to 2.5C and 120 lux, were negatively phototactic in a light gradient (25 to 1 lux), but positively thermotactic in a temperature gradient (4.1 to 1.9C). Both responses were reversed under anoxia. Light was more directing than temperature under the prevailing conditions. (Katz-EIS)
W78-06162

DELETERIOUS EFFECTS OF CYANIDE ON EARLY LIFE STAGES OF ATLANTIC SALMON (SALMO SALAR),
Concordia Univ., Montreal (Quebec). Dept. of Biological Sciences.
G. LeDuc.
Journal of the Fisheries Research Board of Canada, Vol. 35, 1978, p 166-174. 4 tab, 4 fig, 27 ref.

Descriptors: *Bioassay, *Water pollution effects, Methodology, Laboratory tests, *Atlantic salmon, *Industrial wastes, *Toxicity, Juvenile fish, *Fish eggs, Hatching, Salmon, Growth stages, Growth rates, Fish reproduction, Fish physiology, *Cyanide, *Hydrogen cyanide, Newly fertilized eggs, *Sublethal concentrations.

Hydrocyanic acid, a common industrial pollutant, caused severe damage to developing embryos of Atlantic salmon (Salmo sala) when newly fertilized eggs were continually exposed to sublethal concentrations of the poison (0.01-0.10 mg/L HCN) up to the end of the sac-fry stage. At 0.08 and 0.10 mg/L, cyanide delayed hatching by 6-9 days but all concentrations reduced hatching success by about 15-40%. During incubation conversion of yolk into body tissues was reduced at all concentrations above 0.01 mg/L. The most striking effect of cyanide, however, was a high incidence of abnormalities ranging from about 6% at 0.01 mg/L to about 19% at 0.10 mg/L. During incubation cyanide had reduced development, but after hatching survival was not affected and growth of cyanide-exposed sac fry was either equal to or faster than that of the controls as a result of higher yolk conversion efficiency. To protect salmon streams during embryo-larval stages, the maximum acceptable toxicant concentration for cyanide should not exceed 0.005 mg/L HCN. (Katz-EIS)
W78-06163

BLOOMS OF GYRODINIUM AUREOLUM (DINOPHYCEAE) IN NORTH EUROPEAN WATERS, ACCOMPANIED BY MORTALITY IN MARINE ORGANISMS,
Oslo Univ. (Norway). Dept. of Limnology. and Oslo Univ. (Norway) Inst. of Marine Biology.
K. Tangen.
Sarsia, Vol 63, p 123-133, 1977. 3 fig, 1 tab, 36 ref.

Descriptors: *Dinoflagellates, *Mortality, *Eutrophication, *Oxygen demand, *Oxygen requirements, *Red tide, *Fishkill, *Gymnodinium, *Fish toxins, Aquatic algae, Littoral, Salinity, Invertebrates, *Gyrodinium, *Norway coastal water.

Mass occurrence of the dinoflagellate Gyrodinium aureolum in coastal waters was accompanied by fish mortality in floating net cages and by mortality in various littoral organisms. Cell concentrations above 20 million cells per litre were recorded in coffebrown patches in sheltered localities. The hydrographical and meteorological records indicate that the bloom started after a wind-conditioned upwelling, and proceeded in water masses affected by heavy freshwater runoff. The morphology and taxonomy of G. aureolum are discussed, and a synopsis is presented of the occurrence of this species. Mortality in various marine organisms during blooms of G. aureolum is discussed. (Dael - EIS)
W78-06165

THE EFFECT OF TEMPERATURE ON THE DISTRIBUTION AND BIOMASS OF MYTILUS EDULIS IN THE ALAMITOS BAY AREA,
Claremont Graduate Schools, CA. Dept. of Joint Science.
C. R. Feldmeth, and M. Alpert.
The Veliger, Vol 20, No 1, p 39-42, 1977. 1 fig, 1 tab, 7 ref.

Descriptors: *Thermal pollution, *Thermal water, *Water temperature, *Cooling water, Electric powerplants, *Dissolved oxygen, *Salinity, *Larval growth stage, *Mussels, *Biomass, Growth stages, Water pollution effects, *California, Distribution, *Alamitos Bay(Calif).

The effects of thermal effluent on the distribution of this bivalve are examined. The waterway used by four electrical power generating plants for cooling purposed was found to have a much lower abundance of M. edulis. The elevation of water temperature by up to 10C was postulated to affect the survival of the gamete and larval stages. (Dael - EIS)
W78-06166

SOURCES OF VARIABILITY IN THE BENTHIC MACROFAUNA OFF THE SOUTH NORTHUMBERLAND COAST, 1971-1976,
Dove Marine Lab., Cullercoats, (England).
For primary bibliographic entry see Field 2L.
W78-06167

PHYSIOLOGICAL INDICES OF STRESS IN MYTILUS EDULIS,
Institute for Marine Environmental Research, Plymouth (England).
J. Widdows.
Journal of the Marine Biological Association of the United Kingdom, Vol 58, p 125-142, 1978. 9 fig, 3 tab, 33 ref.

Descriptors: *Mussels, Size, *Growth rates, *Growth stages, *Seasonal, *Mortality, *Suspension, Animal physiology, *Animal metabolism, Regression analysis, Oxygen, Nitrogen, Methodology, Bivalve, Acclimation.

Multiple regression equations and response surfaces are used to describe the combined effects of body size, food concentration, acclimation temperature, and season on physiological integrations such as the scope for growth, growth efficiency and O:N ratio. Maintenance and optimum ration levels are estimated for Mytilus edulis adapted to different factor combinations. Response surfaces illustrate the validity and sensitivity of the physiological integrations in quantifying the 'physiological condition' and the degree of stress experienced, under conditions ranging from near optimal, through sub-lethal to lethal. (Dael-EIS)
W78-06168

HEAVY METALS IN THE BURROWING BIVALVE SCROBICULARIA PLANA FROM THE TAMAR ESTUARY IN RELATION TO ENVIRONMENTAL LEVELS,
Marine Biological Association of the United Kingdom, Plymouth (England). Plymouth Lab.
G. W. Bryan, and H. Uysal.
Journal of the Marine Biological Association of the United Kingdom, Vol 58, p 89-108, 1978. 8 fig, 3 tab, 21 ref.

Descriptors: *Heavy metals, Lead, Copper, Calcium, Cobalt, Chromium, Manganese, Nickel, Zinc, *Seasonal, Size, *Sediments, *Mollusks, Metals, *Animal metabolism, *Animal physiology, Water pollution effects, Path of pollutants, *River Tamar estuary(England), Tissue analysis, Bioaccumulation, Bivalve, *Scrobicularia.

Concentrations of ten metals (Ag, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, Zn) have been measured in the the whole soft parts and digestive gland of Scrobicularia plana. Four metals (Cu, Fe, Mn, Zn) have been analysed in the individual tissues including the shell. As far as possible, cncentrations in the animals have been related to those in the environment. Seasonal variation, level on the shore and size of animal have also been considered. Partitioning of metals between the digestive gland and remaining soft tissues suggests that uptake of Cd, Co, Cr, Ni, Pb, and Zn occurs mainly through ingestion of sediments. Scrobicularia plana appears to have potential as an indicator of the availability of metals in estuaries and results for Cu, Fe, Mn, and Zn suggest that there were no important changes in the Tamar estuary between 1969 and 1974. (Dael-EIS)
W78-06169

FEEDING RATE OF MYTILUS EDULIS L. (BIVALVIA) FROM DIFFERENT PARTS OF DANISH WATERS IN WATER OF DIFFERENT TURBIDITY,
Copenhagen Univ. (Denmark). Zoological Lab.
For primary bibliographic entry see Field 2L.
W78-06170

MAINTENANCE OF A TROUT FISHERY BY AERATION IN A EUTROPHIC LAKE,
Adelphi Univ., Oakdale, NY. Inst. of Marine Science; and Adelphi Univ., Garden City, NY.
For primary bibliographic entry see Field 5G.
W78-06171

RELATION OF WATER TEMPERATURE TO INFECTIONS OF COHO SALMON (ONCORHYNCHUS KISUTCH), CHINOOK SALMON (O. TSHAWYTSCHA), AND STEELHEAD TROUT (SALMO GAIRDNERI) WITH AEROMONAS SALMONICIDA AND A. HYDROPHILA,
Oregon State Univ., Corvallis. Dept. of Microbiology.
W. J. Groberg, Jr., R. H. McCoy, K. S. Pilcher, and J. L. Fryer.
Journal of the Fisheries Research Board of Canada, Vol 35, No 1, p 1-7, 1978. 1 fig, 6 tab, 6 ref.

Descriptors: *Water temperature, *Fish diseases, *Juvenile growth stage, *Salmonids, *Infection, *Chinook salmon, *Sockeye salmon, *Rainbow trout, Mortality, *Bacteria, *Epizootiology, Growth stages, Growth rates, *Septicemia, *Aeromonas, *Furunculosis.

Juvenile steelhead trout, coho salmon, and spring chinock salmon were infected by injection with Aeromonas salmonicida or A. hydrophila at seven temperatures from 3.9 to 20.5C. At 3.9 and 6.7C, mortality in fish infected with A. salmonicida varied from 2 to 26% among the three salmonid species. At 20.5C, 93-100% of these animals died within 2 or 3 days; at 6.7C or lower the fish survived for 12-23 days. Growth of A. salmonicida in vitro was influenced by temperature in a manner very similar to its influence on the in vivo infection. Comparable experiments with A. hydrophila gave results much like those with A. salmonicida, though some differences were noted. At a temperature of 20.5C percent mortality ranged from 64 to 100%. At 9.4C or below no deaths attributed to A. hydrophila occurred. Fatally infected fish died more rapidly at the higher temperature. (Dael-EIS)
W78-06172

PALEOGEOCHEMISTRY AND INTERSTITIAL WATER CHEMISTRY FROM SEDIMENTS OF FIVE MAINE LAKES,
Maine Univ. at Orono. Dept. of Geological Sciences.
For primary bibliographic entry see Field 2H.
W78-06199

5D. Waste Treatment Processes

A WATER QUALITY PLANNING MODEL WITH MULTIPLE TIME, POLLUTANT, AND SOURCE CAPABILITIES,
Meta Systems Inc., Cambridge, MA.
For primary bibliographic entry see Field 5B.
W78-05702

AN EVALUATION OF ALTERNATIVE SLUDGE TECHNOLOGIES: A SURROGATE WORTH TRADEOFF APPROACH,
New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.
For primary bibliographic entry see Field 5E.
W78-05707

TREATMENT OF WASTE WATER CONTAINING AMMONIUM SULPHATE AND ORGANIC CPDS.--BY ADDING LIME TO PPTE. CALCIUM SULPHATE; CONTACTING WITH HOT AIR TO REMOVE AMMONIA AND INCINERATING RESIDUE.
French Patent FR 2338-902. Issued September 23, 1977. Derwent French Patents Abstracts, Vol Y, No 48, p 2, January, 1978.

Descriptors: *Ammonium compounds, *Sulfur compounds, *Ammonia, *Patents, *Lime, Chemical precipitation, Sulfates, Organic wastes, Evaporation, Incineration, Industrial wastes, Chemical wastes.

A patent has been issued for a lime treatment process to be used in the removal of ammonium ions, sulfate ions, and organic materials from waste water resulting from the production of acrylonitrile and methacrylate. Lime is added to the ion-bearing effluent to bring about the precipitation of sulfate ions as calcium sulfate and the conversion of ammonium ions to ammonia. The recovery of ammonia and water from the effluent is accomplished by the distillation of the ammonia and water with the introduction of hot air. The residue, which must be maintained at a pH of at least 8.5, is placed in a furnace with a fluidized bed and incinerated at a temperature of 700-1,000C. The hot combustion gases created during the incineration of the residues are recovered and reused in the hot air evaporation process. (Lisk-FIRL)
W78-05708

A MODEL FOR PLANNING AND LOCATION OF ON-SITE WASTE DISPOSAL SYSTEMS,
Wisconsin Univ., Madison. Coll. of Agricultural and Life Sciences.
For primary bibliographic entry see Field 5E.
W78-05713

DESIGN OF LARGE URBAN SEWER SYSTEMS WITH A WATER-FLOW SIMULATION PROGRAM,
Balzari Blaser Schudel, Bern (Switzerland).
P. Kaufmann, and C. de Rham.
In: Mathematical Models for Environmental Problems. Proceedings of the International Conference, University of Southampton, England, September 8-12, 1975. C.A. Brebbia (Ed.), Southampton Univ. John Wiley & Sons, N.Y., p 79-86, 1976. 5 fig, 3 ref.

Descriptors: *Simulation analysis, *Computer models, *Sewers, *Networks, Computer programs, Design, Planning, Urban runoff, Hydrographs, Construction costs, Optimization.

This short article discusses a simulation model built to calculate the hydrographs (discharges, depths, velocities and volumes in function of time) at every node of large sewage networks. The computer program in FORTRAN includes elements like stormwater tanks, outflow sewers, storage sewers and downward ramifications. The computer modeling method has been applied successfully for the optimal design of networks, extensions and special cases. (See also W78-05720) (Bell-Cornell)
W78-05722

BIOLOGICAL TREATMENT OF SPENT VEGETABLE TANNINS WITH FUNGAL DOMINANT SYSTEM,
West Virginia Univ., Morgantown.
M. D. Atluru.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 552, Price codes: A12 in paper copy, A01 in microfiche. PhD Thesis, 1972. 244 p, 34 fig, 61 tab, 106 ref, 3 append. OWRT A-015-WVA(2).

Descriptors: *Fungi, *Biological treatment, Activated sludge, Industrial wastes, Degradation(Decomposition), Water purification, Aerobic treatment, *Waste water treatment, Water pollution, *Tannins.

Feasibility of aerobic biological treatment of spent vegetable tannins with primarily fungal culture was investigated. Growth rate of cells, yield coefficients, oxygen uptake rate, specific substrate utilization rates, sludge settleability, and process performance in a mixed culture with a high percentage of fungi under various conditions of detention time, organic loading, and pH of the reaction were examined. Laboratory batch culture work was followed by two continuous flow bench-scale reactors (10 liter capacity). Continuous flows culture treatment determined 10 days as the optimum detention time for best removals of organics at a tannic acid level of 5,200 mg/l. Sludge settling characteristics improved at higher detention times. With same conditions, reactor performance improved as the pH of the reactor increased and a sludge with better settling characteristics was produced. With increased organic loading rate, process efficiency and sludge settleability decreased at a constant hydraulic loading. Sludge settling characteristics of the treated tans seemed to correlate with fungal-bacterial-protozoan interrelationships. Chromatographic analysis indicated that primary degradation products of hydrolyzable tans and sugars in the spent liquor were removed possibly by some biological action in the tannery. Total oxygen content constitution was attributed to non-tannin phenolic compounds, Flavonoid compounds, and nonphenolics. Spent vegetable tannins wer biodegradable by an adapted fungal culture and appropriate for biological treatment in an external aeration type activated sludge process. (Wares-IPA)
W78-05807

EFFECT OF ARTIFICAL AERATION ON PROCESSES OF SELF-PURIFICATION IN CLARIFIERS OF A SUGAR REFINERY, (IN RUSSIAN),
Akademiya Nauk URSR, Kiev. Inst. Hidrobiologii.
A. K. Ryabov, T. Ya. Smikun, L. V. Podgaevskaya, and Zh. M. Aryamova.
Gidrobiol Zh 13(1), p 28-35, 1977.

Descriptors: *Self purification, Clarifiers, Industrial wastes, *Aeration, Waste water treatment, Artificial aeration, *Sugar refinery wastes, Aphanizomenon-flos-aquae, Nitrogen, USSR.

The dynamics of the main components of water chemical composition and the changes in microflora were studied under the effect of aeration by the method of air bubbling through the disc aerators. Application of artificial aeration in ponds of the Bobrovitsa (USSR) sugar-refinery caused a 2.5-fold increase in the mineralization rate of N-containing organic compounds as a result of which the sanitary state and organoleptic properties of water improved. Artificial aeration is established to suppress development of blue-green algae (Aphanizomenon flos -aquae) in the spring-summer period.--Copyright 1978, Biological Abstracts, Inc.
W78-05812

URBAN STORM WATER MANAGEMENT,
For primary bibliographic entry see Field 5G.
W78-05821

SIMPLE METHODS FOR RAINFALL-RUNOFF-PROCESS. RUNOFF HYDROGRAPH CURVES FOR RAIN AND MIXED WATER CANALS (EINFACHE MODELLE FUER NIEDERSCHLAG-ABFLUSS-PROZESSE. ABFLUSSGANGLINIEN FUER REGEN UND MISCHWASSERKANAELE),
H. W. P. Schulz.
Wasser und Boden, Vol. 30, No. 1, p 2-5, 1978. 7 fig, 3 ref.

Descriptors: *Storm water, *Urban runoff, *Mathematical models, *Model studies, *Sewers, Rainfall-runoff relationships, Hydrograph analysis, Estimating, Design criteria, Analytical techniques, Hydrologic aspects, Waste water treatment.

Runoff retention and runoff hydrograph curves were derived from rainfall curves on the basis of translation and retention of water as applied to sewer system design. The basic models, integrated by means of hyperbolic functions, are suitable for engineering calculations. They are also more flexible than the summation curve and time constant methods. (Takacs-FIRL)
W78-05823

GROUND PROBLEMS OVERCOME ON CRAWLEY SEWER JOB.
For primary bibliographic entry see Field 8D.
W78-05824

TOXIC WASTE DUMPING INCIDENT DEMONSTRATES SURVEILLANCE NEEDS.
For primary bibliographic entry see Field 5G.
W78-05825

PROTECTION OF UNDERGROUND WATER MAINS AGAINST CORROSION,
Bombay Municipal Corp., Bombay (India).
For primary bibliographic entry see Field 8G.
W78-05826

USE OF MIXING PIPES TO IMPROVE THE FLOW OF WASTE WATER INTO LAKES (EINSATZ VON MISCHROHREN ZUR VERBESSERUNG DER EINLEITUNG VON ABWASSER IN SEEN),
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
For primary bibliographic entry see Field 5E.
W78-05829

FLOW ATTENUATION IN SEWERS,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Hydraulic Engineering.
For primary bibliographic entry see Field 8B.
W78-05830

ELECTROLYTIC FLOCCULATION PLANT--ESPECIALLY FOR ACTIVATED SEWAGE SLUDGE PROCESSING.
German Patent DS 2259-020. Issued November 17, 1977. Derwent German Patents Abstracts, Vol. Y, No. 47, p 2-3, January, 1978.

Descriptors: *Activated sludge, *Flocculation, *Anodes, *Cathodes, *Electrodes, *Patents, Separation techniques, Design data, Sludge disposal, Waste water treatment, Municipal wastes, Treatment facilities.

A process for the treatment of sludge using electrolysis has been patented. Sludge is fed into a flotation cell which has inlets for sludge and outlets for the treated water. A uniform surface scum layer and more efficient water drainage are created by the homogeneous flow conditions within the cell. The sludge inlet and clarified water drain are located along the full length of the gas bubble-producing electrode apparatus. Anodes and cathodes are superimposed on the bottom of the cone-shaped container. The anodes form a grid with the cathode plate placed beneath them. Sludge is passed along the entire length of this arrangement to bring about electrolytic flocculation. The process is especially effective in activated sludge treatment. (Lisk-FIRL)
W78-05831

PURIFICATION AND CLARIFICATION OF SEWAGE--USING A FINELY DIVIDED COAGULATION-ADSORPTION MATERIAL HAVING A THIN HYDROXYLATED SURFACE.
Netherlands Patent NL 7704-854. Issued November 7, 1977. Derwent Netherlands Patents Report, Vol. Y, No. 47, p 6, January, 1978.

Descriptors: *Zeta potential, *Coagulation, *Adsorption, *Oxides, *Silicates, *Patents, Separation techniques, Waste water treatment, Municipal wastes, Water treatment.

A patent has been issued for a waste water treatment process which involves the use of a coagulant-adsorbing agent for clarification. Suspended solids, covered matter, and microorganisms are removed by the addition of a finely divided material which has the capacity for both coagulation and adsorption. The material has a thin hydroxylated layer which is derived from the finely divided material or from other materials. This coagulating and adsorbing material has individual particles with thin hydroxylated surfaces having positive zeta potentials. The zeta potential is determined by pH absorption. The coagulating agent with a hydroxylated layer in the form of finely divided material is preferably derived from oxides or silicates. (Lisk-FIRL)
W78-05832

PLANT FOR ACTIVATED SLUDGE TREATMENT OF EFFLUENT--OF COMPACT DESIGN AND CONSTRUCTION.
Belgian Patent BE-855-140, Issued November 28, 1977. Derwent Belgian Patents Abstracts, Vol Y, No 48, p 3-4, January, 1978.

Descriptors: *Activated sludge, *Sludge disposal, *Aeration, *Settling basins, *Sewage treatment, Separation techniques, *Patents, Equipment, Design data, Waste water treatment, Municipal wastes.

A compact plant for the treatment of waste water by the activated sludge process has been patented. Screening of large solids from the effluent is conducted in an excavated earthen basin formed by a dam. The resulting solids are pulverized with a comminuting pump. The waste water is aerated and stirred in a circular motion by gas jets in the aeration basin. Waste material is contantly removed from the center of the basin. A channel runs horizontally from the top of the aerator to a distributor in the center of the settling basin. A scraper continuously removes sludge from the settling basin. The sludge is stored in a lagoon. One side of the unit corresponds in length to the largest dimension of the largest piece of equipment. The parallel remaining side is equal in length to the summation of the smallest dimension of the largest unit and the largest dimension of another unit. (Lisk-FIRL)
W78-05833

TREATING WASTE WATER, ESPECIALLY FROM CESS PITS, WITH FLOCCULANTS--THEN GRAVITY FILTRATION THROUGH TEXTILE TO REDUCE SOLIDS AND BOD.
Belgian Patent BE-854-634. Issued November 14, 1977. Derwent Belgian Patents Abstracts, Vol Y, No 47, p 2, January, 1978.

Descriptors: *Flocculation, *Filtration, *Cesspools, *Patents, *Waste water treatment, Separation techniques, Design data, Biochemical oxygen demand, Chemical oxygen demand, Municipal wastes.

A waste water treatment process utilizing flocculation followed by filtration through a support material has been patented. Flocculants are applied to the effluent in the first stage of treatment. The waste water is then passed through a gravity filter for the removal of suspended solids. The gravity filter consists of an apparatus containing a textile support and the separated solids. The process has proven effective in reducing the BOD and removing up to 20,000 mg/liter of COD from the effluent. The treatment has been shown to be an effective initial separation step in the processing of cesspool and sludge collector effluents. This preliminary separartion process is purported to be less expensive, more adaptable, and less time consuming than conventional separation techniques. (Lisk-FIRL)
W78-05834

AEROBIC SEWAGE TREATMENT SYSTEM.
Australian Patent 487,544. Issued October 27, 1977. The Australian Official Journal of Patents, Trade Marks, and Designs, Vol 47, No 40, p 3642, October, 1977.

Descriptors: *Aeration, *Aerobic treatment, *Patents, *Activated sludge, *Design data, Sewage treatment, Waste water treatment, Waste water disposal, Equipment.

A patent has been issued for a divided aeration tank which provides automatic sewage treatment with low maintainance for individual domestic use. The unit employs an aeration tank with a perforated divider forming two aeration chambers. Raw sewage enters the first aeration chamber through an inlet and passes into the second aeration chamber. An airlift pump in the second chamber continuously pumps sewage and waste water into a separate tank for settling and maintains a constant level of fluid just below the sewage inlet. Liquid level maintenance by the airlift pump enables the aeration tank to withstand shock hydraulic loads. The separate settling tank is equipped with several settling acceleration plates, slanted in the direction of the aeration tank, which transfer effluent to a filter bed. (Lisk-FIRL)
W78-05835

HORIZONTAL AXIS AERATING ROTOR FOR WASTE WATER TREATMENT--USES POLYGONAL ROTOR NODULES WITH ANGLED BEATER BLADES.
French Patent FR-2344-503. Issued November 18, 1977. Derwent French Patents Abstracts, Vol A, No 2, p 3-4, February, 1978.

Descriptors: *Activated sludge, *Rotors, *Aeration, *Oxygenation, *Patents, Biological treatment, Design data, Equipment, Waste water treatment, Municipal wastes.

A waste water aeration system with modular polygonal rotors and angled beater blades has been patented. Polygonal end plates forming coaxial modules are attached to a horizontal rotary shaft. The corresponding end plates are connected by flat stringer plates equipped with beater blades along the outer edges. The beater blades are all positioned at the same angle with respect to the rotary shaft's axis. Subsequent modules are fitted with increasingly angled beater blades, with increments of 15 degrees for each successive module. The maximum angle of the beater blades should be no more than 60 degrees. The hexagonal side plates are bent toward the center of the module. As the rotary shaft turns the module, the beater blades along the stringer plates mix the waste water. The water is oxygenated by the rotating beater blades as it passes through the biological treatment tank. It is suggested that beater blades are more easily installed on the flat surface of a polygonal rotor. (Lisk-FIRL)
W78-05836

SEWAGE SETTLING TANK WITH FLOATING SIPHON SYSTEM--HAS BAFFLES FORMING CLEAR WATER ZONE ABOVE TUBE SETTLERS.
French Patent FR-2344-502. Issued November 18, 1977. Derwent French Patent Abstracts, Vol A, No 2, p 3, February, 1978.

Descriptors: *Settling basins, *Water purification, *Sludge treatment, *Siphons, *Patents, Conveyance structures, Design data, Equipment, Waste water treatment, Sludge disposal, Separation techniques, Municipal wastes.

A patent has been issued for a waste water settling system which produces clarified water and siphons off settled sludge. Th settling tank contains two or more banks of tube settlers located on a horizontal plane near the tank's bottom. Baffles, containing scaled floating carriage openings at one end, extend vertically from rhe settler banks to form a clarified water area. Water levels are maintained by outlets in the clear water zone. A siphon, supported by the foating carriage, extends horizontally between the settlers and removes sludge through inlets located on lateral branches. Untreated liquid is prevented by a seal from flowing through the carriage inlet in the baffle and into the clarified water zone. The clear liquid is removed through outlets located near the settling banks. (Lisk-FIRL)
W78-05837

ACTIVATED SLUDGE EFFLUENT TREATMENT--WITH EJECTOR AERATING/EFFLUENT CIRCULATING SYSTEM IN A TREATMENT TRENCH.
German Patent DS-2404-289. Issued December, 29, 1977. Derwent German Patents Abstracts, Vol. A, No. 2, p 3, February, 1978.

Descriptors: *Activated sludge, *Aeration, *Patents, *Sludge treatment, *Bubbles, Gases, Pressure, Design data, Equipment, Waste water treatment, Municipal wastes.

An effluent aeration and circulation tank to be used during activated sludge treatment of waste water has been patented. Gas-injecting aeration nozzles are mounted near the bottom of the activated sludge tank. A gas-fluid mixture is injected into the sewage sludge at an impulse density of 3-5 kilopascals to produce a sludge impulse density of 90-500 pascals. The gas-liquid injection nozzles are positioned asymmetrically with respect to the tank's cross section. This causes the activated sewage sludge to flow in a closed horizontal circuit within the tank. The columns of rising bubbles are rotated by the injected gas-fluid mixture. This motion prevents the settling of the activated sludge within the system during treatment. (Lisk-FIRL)
W78-05838

AEROBIC BIOLOGICAL PURIFICATION OF POLLUTED EFFLUENT--BY DISSOLVING OXYGEN AT PROGRESSIVELY INCREASING LIQUID PRESSURE.
Netherlands Patent NL-7706-126. Issued December 12, 1977. Derwent Netherlands Patents Report, Vol. A, No. 1, p 2, February, 1978.

Descriptors: *Biological treatment, *Aeration, *Water pressure, *Patents, *Oxygenation, Waste water treatment, Design data, Equipment, Activated sludge, Municipal wastes.

A patent has been issued for a compact waste water aeration process using compression and decompression coils for increased oxygenation during biological treatment. The compression coil is a flat, spiral pipe which rotates about a vertical axis. Waste water is introduced into the center of the coil and the force of rotation draws the liquid towards the periphery of the coil. The pressure of the liquid increases to a maximum at the periphery of the coil; oxygen-bearing air is injected to the liquid as it passes through the coil. This coil also rotates around a vertical axis, preferably attached to the same drive shaft and rotating coaxially with the compression coil. The liquid passes from the outside of the decompression coil. The liquid passes from the outside of the decompression coil towards its interior axis, decreasing in pressure as it approaches the central outlet. A portion of liquid-entrained sludge is removed from the decompression coil before it passes through the outlet and is returned to the compression coil. The purified liquid from the decompression coil is passed through a degassing device before discharge. (Lisk-FIRL)
W78-05839

BAND PRESSURE FILTER FOR DEHYDRATING WASTE WATER SLUDGE ETC.--HAS POWER CYLINDER BAND TENSIONING TO COMPENSATE FOR CAKE THICKNESS VARIATION.
Netherlands Patent NL-7705-632. Issued December 13, 1977. Derwent Netherlands Patents Report, Vol. A, No. 1, p 2, February, 1978.

Descriptors: *Dewatering, *Sludge treatment, *Hydraulic structures, *Patents, *Filtration, Separation techniques, Design data, Equipment, Dehydration, Waste water treatment, Sludge disposal, Municipal wastes.

A patent has been issued for a pressurized sludge filtration and dewatering system. A set of filter bands is positioned on a series of rollers which rotate in alternate directions. The sequential rollers have diminishing diameters; the first roller has a diameter five times greater than that of the next two rollers and twice that of the fourth and fifth rollers. The rollers, which are positioned to hold the filter bands in tension, are mounted on pivoting arms whose axes are rotated by power cylinders. The cylinders are provided with actuating liquid at a pressure equal to the pressure of the tension rollers. The sludge is dewatered as it is passed between the bands and the rollers. As the bands rotate around the rollers, one band acts as a filtering device while the other applies pressure. Since the bands remain taut, sludges of differing thicknesses are allowed to pass between the bands for dewatering. (Lisk-FIRL)
W78-05840

BIOLOGICAL EFFLUENT PURIFICATION AND CLARIFICATION EQUIPMENT--WITH AERATORS, FLOTATORS AND SCRAPER CONVEYOR TO REMOVE ACTIVATED SLUDGE WHICH IS THICKENED.
Soviet Patent SU-548-574. Issued March 14, 1977. Derwent Soviet Inventions Illustrated, Vol. 8, No. 1, p 3, February, 1978. 1 fig.

Descriptors: *Activated sludge, *Patents, *Aeration, *Flotation, *Sludge treatment, Design data, Sludge digestion, Biological treatment, Separation techniques, Waste water treatment, Municipal wastes.

A patent for a biological treatment unit with an activated sludge removal and thickening system is presented. Effluent is drawn through an intake pipe into the activated sludge tank where it is mixed by automatic intake aerators. Flotators, located in the bottom of the tank, separate the activated sludge by injecting it with air bubbles which rise to the surface as the liquid passes through the distribution system. The clarified liquid is transferred to a trough where it overflows into an intermediate collection tank. Partial recirculation of the clarified liquid is accomplished by a pump; the remainder of the water passes through outlets for further processing. A scraper mechanism removes the excess activated sludge and thickens it before transferring the sludge into gulleys for removal to additional treatment processes. The activated sludge is thickened by hollow, cylindrical elements located above the flotators. (Lisk-FIRL)
W78-05841

WASTE WATER FLAME DECONTAMINATION--BY DIVIDING HIGH TEMPERATURE COMBUSTION PRODUCTS INTO NUMBER OF STREAMS CORRESPONDING TO NUMBER OF CONTROL STAGES.
For primary bibliographic entry see Field 5E.
W78-05842

WASTEWATER PLANT HAS AN EYE ON THE FUTURE,
Raleigh Pollution Control Office, NC.
W. P. Cannon.
Water and Wastes Engineering, Vol 14, No 12, p 20-26, December, 1977. 1 fig.

Descriptors: *Waste water treatment, *Treatment facilities, *Sludge treatment, *Aeration, *North Carolina, Sewage treatment, Tertiary treatment, Carbon filters, Chlorination, Municipal wastes, Sanitary engineering, Settling basins, Filtration, Pumps.

The operation of the recently completed waste water treatment facility in Raleigh, North Carolina, is examined. The 30 mgd operation was designed to provide waste water treatment for Raleigh's increasing population through the year 2020 with provisions for expansion to a capacity of 100 mgd. During primary treatment the raw waste water is pumped through coarse bar screens where solids are removed for transport to a sanitary landfill. The first part of secondary treatment includes aeration, followed by secondary settling in earthen basins equipped with drains for transfer of influent to other treatment units. Settled waste water then flows to the return sludge screw pump station and onto secondary clarifiers. A Parshall flume at the return sludge metering station monitors the return flow. Sludge treatment is accomplished by aerobic digesters, sludge thickeners, dewatering, sludge treatment is accomplished by aerobic degesters, sludge thickeners, dewatering, and sludge oxidation. Secondary effluent is processed through automatically backwashed tertiary filters at a rate of 3-7.5 gal/sq ft/min. The backwash rate is 5-22.5 gal/sq ft/min. Effluent is polished by filtration through layers of anthracite coal, sand, and gravel. Chlorination is accomplished by: three chlorinators, each with a capacity of 8000 lbs chlorine gas/24 hrs; three electrical chlorine evaporators; and a chlorine residual analyzer. The plant consists of an administration and laboratory building, a filter building, and a sludge dewatering building. (Lisk-FIRL)
W78-05843

PERFORMANCE OF THE ACTIVATED SLUDGE PLANT,
Bombay Municipal Corp. (India). Dadar Sewage Purification Plant.
D. S. Joshi.
Indian Journal of Environmental Health, Vol 19, No 3, p 238-243, 1977. 1 fig, 3 tab, 3 ref, 2 append.

Descriptors: *Activated sludge, *Aeration, *Biochemical oxygen demand, *Suspended solids, *Treatment facilities, Sludge treatment, Sanitary engineering, Sewage treatment, Municipal wastes, Waste water disposal.

Dadar Sewage Treatment Works in Bombay, India, has a total capacity of 20 mgd using the activated sludge process and trickling filters. Sewage receives primary treartment only. Suspended solids, BOD, and oxygen absorption in treated effluent were measured over a two-year period after a renovation of the sewage treatment plant. The aeration system, site of the renovation, was changed by the replacement of 36 aeration cones by 24 cones installed in four rows. Each aeration cone runs on a six horsepower motor and the 24 cones have the same flow capacity as the original 36 cones. Return sludge pump capacities were increased to 60-65% from 30-35%. Suspended solids levels after primary treatment were reduced by 64.6%, BOD was reduced by 32.4%, and four-hour potassium permanganate absorption by 41.4%. (Lisk-FIRL)
W78-05844

THIS PLANT MARRIES TWO WASTES,
Wiley and Wilson, Inc., Lynchburg, VA.
W. H. Clingenpeel.
Water and Wastes Engineering, Vol 14, No 12, p 36-39, December, 1977. 2 fig.

Descriptors: *Pulp wastes, Pulp and paper industry, *Municipal wastes, *Industrial wastes, *Treatment facilities, *Virginia, Biochemical oxygen demand, Sludge treatment, Nitrogen, Chlorination, Waste water treatment.

A Virginia waste treatment plant has been redesigned to treat both municipal and industrial wastes. Mead Corporation's Paperboard Mill in Virginia underwent processing modifications that included elimination of pulping, recycling of paper, and recycling of process water. Lynchburg, Virginia's waste treatment facility was upgraded from an 11-mgd primary capacity to a 22-mgd secondary treatment capacity plant. The Mead waste water flow was estimated at 3.0 mgd with a BOD of 14,000 lbs/day. Because treatment of the combined primary sludges was found to be ineffective, primary settling and disposal of the domestic and industrial sludges were conducted separately. Two variable speed pumps and two constant speed pumps, each with a 15 mgd capacity, convey the raw sewage through a Parshall flume to the primary clarifiers. The sludge removal clarifiers were installed to supplement the two existing clarifiers. A second chlorine tank, a wet air oxidation system, and two sludge dewatering centrifuges were also added to the treatment plant. An ammoniator was added to compensate for the nitrogen deficiency of the industrial flow. The chlorinators and evaporators, with a 16,000 lbs/day capacity, supply high-pressure process water to the plant via a non-potable water pumping station. (Lisk-FIRL)
W78-05845

AEROBIC SLUDGE DIGESTION AT COLD TEMPERATURES,
British Columbia Univ., Vancouver. Dept. of Civil Engineering.
D. S. Mavinic, and D. A. Koers.
Canadian Journal of Civil Engineering, Vol 4, No 4, p 445-454, December, 1977. 8 fig, 1 tab, 17 ref.

Descriptors: *Aerobic treatment, *Activated sludge, *Suspended solids, *Temperature, *Biochemical oxygen demand, Sludge digestion, Sludge treatment, Municipal waste, Waste water treatment.

The effects of low temperature on the aerobic digestion of activated sludge were examined. Three digester operations, continuous feed, daily fill, and batch aeration, were compared using six sludge ages. Lower temperatures and decreased sludge age were observed to decrease the volatile suspended solids removal rates. A similar reduction in volatile suspended solids removal occurred in the continuous and semi-continuous feed digesters operated at 20C and 10C. At 5C, the volatile suspended solids reduction was greater under semi-continuous operation than in the continuous flow mode for all sludge ages tested. Batch aeration exhibited a high degree of volatile suspended solids removal at 20C when compared to continuous flow operation at the same temperature, although the reverse proved true at 10C. Batch aeration and semi-continuous flow operations at 5C showed similar reduction rates. Volatile suspended solids removal was significantly decreased in laboratory experiments and studies at two treatment plants when the value of the product of sludge age and temperature exceeded 250. Oxygen uptake rates and BOD levels were also significantly affected by sludge age and temperature. (Lisk-FIRL)
W78-05846

CHLORINE AND ACID CONDITIONING OF SLUDGE,
California State Water Resources Control Board, Sacramento.
W. H. Sukenik, P. H. King, and J. W. Olver.
Journal of the Environmental Engineering Division, Proceeding of ASCE, Vol 103, No EE6, p 1013-1020, December, 1977. 10 fig, 1 tab, 8 ref.

Descriptors: *Chlorine, *Chlorination, *Acidity, *Filtration, *Chemical oxygen demand, Metals, Chromium, Copper, Zinc, Sodium compounds, Waste water treatment, Anaerobic digestion, Aerobic treatment, Municipal wastes.

The effects of chlorine and acidity on the filterability and release of organic matter and metals from primary sludge after chlorination were analyzed. Samples of raw primary, anaerobically-digested, and aerobically-digested sludge were treated with 500, 700, and 1,000 mg/liter sodium hypochlorite. The pH was varied from 3 to 7 with applications of sulfuric acid or sodium hydroxide. Observations were made on the specific resistence to filtration, COD levels, and the release of chromium, copper, and zinc after chlorine and acid treatment. Filterability of raw primary sludge improved slightly with the addition of 500 mg/liter chlorine at pH 3 and 700 mg/liter chlorine at pH 4. A significant decrease in filterability was observed at pH 5-7 with low chlorine additions, while the lowest sludge filterability occurred with the 100 mg/liter chlorine treatment. A decrease in pH slightly improved the filterability of anerobically digested sludge, although overall filterability was unaffected by chlorine or acid treatment. Aerobically treated sludge demonstrated substantial increases in filterability after acid treatment alone. Filtrate COD after chlorine oxdiation increased in raw sludge at pH 4, increased in anaerobic sludge as the pH was lowered, and increased in aerobic sludge with higher chlorine doses. The release of zinc, copper, and chromium increased for raw and anaerobic sludge after chloride treatment at low pH. (Lisk-FIRL)
W78-05847

EFFECTIVE PHOSPHORUS REMOVAL BY ADDING ALUM TO SEPTIC TANK,
Ontario Ministry of the Environment, Toronto.
M. Brandes.
Journal Water Pollution Control Federation, Vol 49, No 11, p 2285-2296, November, 1977. 6 fig, 4 tab, 29 ref.

Descriptors: *Phosphorus, *Biochemical oxygen demand, *Aluminum, *Septic tanks, *Domestic wastes, Sewage treatment, Separation techniques, Waste disposal, Iron, Sulfates, Sewage effluents, Waste water treatment.

Significant removal of phosphorus and other contaminants from septic tank effluent was achieved by the addition of aluminum sulfate to septic wastes. Additions of 430 mg/liter of alum were made for each toilet flush in a three-person residence in Ontario, Canada. Samples of septic tank effluent and sludge were taken before and after alum application. The amount of soluble phosphorus contained in the effluent was reduced by 99.2%. The addition of 246.8 mg/liter of alum to the waste resulted in 84.9% phosphorus retention in the sludge with 15.1% released in the effluent. With the same alum application, total coliform levels in the effluent were reduced by 35% and fecal coliforms were reduced by 80%. Further total coliform and fecal coliform removal was achieved with the addition of 430 mg/liter of alum. Ninety per cent of the aluminum content was retained in the sludge while a 19% increase in iron in the sludge was realized with the alum treatment. Sludge retention of sodium, potassium, chlorides, and sulfates increased, while sulfate concentrations in septic effluent also increased with alum addition. The average 53.3% BOD removal with 246.8 mg/liter of alum did not significantly improve with greater alum doses. The alum treatment resulted in a higher sludge precipitation rate. (Lisk-FIRL)
W78-05849

SEWAGE PLANT SHOWS OFF FANCY FORMWORK.
Engineering News-Record, Vol 200, No 3, p 52-53, January, 1978.

Descriptors: *Activated sludge, *Aeration, *Biochemical oxygen demand, *Oxygenation, *Storm water, Overflow, Food processing industry, Municipal wastes, Treatment facilities, California, Waste water treatment, Sludge treatment.

A new 300-mgd activated sludge treatment is currently being constructed for the Sacramento County, California area to replace the present 25-mgd plant. The completed treatment system, costing an estimated $395 million, will consist of seven pumping stations, 75 miles of interceptor sewers, and the advanced secondary treatment plant. Five existing digesters will be modified for incorporation into facility; aeration and settlement facilities will be converted to chemical handling facilities. Storm water overflow will be controlled by the present treatment plant which will be converted to a 60-mgd capacity and backed up by a 21,000,000-gal holding lagoon for excess flow. Aeration will be accomplished by a submerged, revolving, conical agitator using high purity oxygen. This type of activated sludge process is considered more effective in controlling BOD of food processing wastes and other organic industrial discharges. Aeration tanks up to 32 feet deep can be used in this system; all facilities will be enclosed to prevent odor emissions. The treatment facility is expected to reduce BOD by 92% and suspended solids by 88%. (Lisk-FIRL)
W78-05850

FROM WASTEWATER TO RESOURCE IN ST. PETERSBURG, FLORIDA,
L. A. Dove.
Resource Recovery and Conservation, Vol 2, No 4, p 329-336, November, 1977. 9 fig, 3 tab, 8 ref.

Descriptors: *Return flow, *Filtration, *Recirculated water, *Tertiary treatment, *Chlorination, Sewage treatment, Potable water, Reclaimed water, Water purification, Irrigation, Injection wells, Municipal wastes, Waste water treatment, Treatment facilities, Florida.

A zero-discharge waste water treatment system currently under construction in St. Petersburg, Florida, is described. The system was designed to furnish irrigation and drinking water to an area surrounded by polluted salt-water bays and with a limited fresh water supply. Designs for the system, the first regional recycling operation of its kind in the country, involve the expansion of the four existing secondary treatment plants in St. Petersburg to an increased combined capacity of 340,000 cu m/day. One plant that has undergone modification and expansion has been able to remove 90% of the BOD and suspended solids from the effluent. A tertiary treatment plant provides multi-media filtration, alum feed at 6.0-7.5 mg/liter as a filter aid, flash chlorination, and chlorine injection in a 38,000-cu m retention pond. The effluent produced is of potable quality at 1-2 JTU with 1.0-1.5 mg/liter of residual chlorine after 30 minutes, and 0.2/100 ml or less coliform count. Treated water is transported via a master pumping station to a 22.5-km distribution system for irrigation. During rainy seasons and other periods when irrigation is unnecessary, the treated water is pumped to a deep injection well system with a capacity of 76,000 cu m/day. Nutrients useful in irrigation are retained in the treated effluent. The treatment process will provide 40% of the potable water demand for area irrigation. (Lisk-FIRL)
W78-05851

INFLUENCE OF TEMPERATURE ON THE PERFORMANCE OF SEPTIC TANK SYSTEMS,
ADI Ltd., Fredericton (New Brunswick).
T. Viraraghavan.
Water, Air, and Soil Pollution, Vol 7, No 1, p 103-110, January, 1977. 2 fig, 1 tab, 13 ref.

Descriptors: *Septic tanks, *Tile drainage, *Domestic wastes, *Biochemical oxygen demand, *Phosphate, Temperature, Drainage systems, Sewers, Waste water disposal, Treatment facilities.

The impact of air, liquid, and soil temperatures on the efficiency of septic tank and subsurface tile field operations was studied. Temperature readings were recorded at a northern Canadian site over the period of more than a year in a tile field and three soil depths, in the septic tank and the surrounding soil, and in the air. Mean monthly air temperatures ranged -11.7-23.7C; the temperature of the sewage in the septic tank never dropped below 15.8C and never exceeded 21.5C. Temperatures inside the tile field ranged 3.3-18.7C; the nearby soil temperatures usually exceeded those of the air. Physical adsorption, especially of phosphates, increased as the temperature decreased. Reduction of BOD at a depth of 1.37 m ranged from a high of approximately 90% at less than 5C to a low of 50% between 10-15C. The sewage effluent temperature was maintained above freezing by hot water discharged into the system. System efficiences during the summer months were higher, ranging 75-85%. (Lisk-FIRL)
W78-05852

MOBILE DIESELS STAND-BY AT SEWAGE PUMPING STATIONS.
For primary bibliographic entry see Field 8C.
W78-05855

LONG-TERM PERFORMANCE OF A COUPLED TRICKLING FILTER-ACTIVATED SLUDGE PLANT,
Brown and Caldwell, Walnut Creek, CA.
R. J. Stenquist, D. S. Parker, W. E. Loftin, and R. C. Brenner.
Journal Water Pollution Control Federation, Vol. 49, No. 1, p 2265-2284, November, 1977. 15 fig, 10 tab, 8 ref.

Descriptors: *Activated sludge, *Trickling filters, *Operation and maintenance, *Treatment facilities, *Design data, Municipal wastes, Sewage treatment, Waste water treatment.

The upgrading of the Livermore Water Reclamation Plant in Livermore, California, and its operation and performance from its startup in early 1967 through its seventh full year of operation in 1974 are reviewed. The expansion involved increased influent and primary effluent pumping capacity, addition of a secondary trickling filter, conversion of the existing secondary sedimentation tank to a primary tank, and increased disinfection capacity. Use of the coupled trickling filter-activated sludge process has resulted in the consistent production of an effluent low in BOD, suspended solids, ammonia, and coliform bacteria. Operational problems appeared to be correctable through newer design techniques. Plants of similar design have either been or are now being constructed in San Pablo and Lompoc, California, and in Corvallis, Oregon. (Baker-FIRL)
W78-05856

TREATMENT OF THERMALLY-CONDITIONED SLUDGE LIQUORS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
U. Loll.
Water Research, Vol. 11, No. 10, p 869-872, 1977. 3 fig, 2 tab, 12 ref.

Descriptors: *Heat treatment, *Sludge treatment, *Biological treatment, *Dewatering, *Aeration, Sewage treatment, Chemical oxygen demand, Biochemical oxygen demand, Filtration, Design data, Waste water treatment.

Studies on the aerobic-thermophilic purification of undiluted filter effluents are described. The highly concentrated substrates from the dewatering of

thermally-conditioned sludges were biologically treated with aerobic-thermophilic processes in batch and continuous systems. Process performance was assessed according to reductions in COD, BOD, total organic carbon, and volatile solids. Temperature, pH, total phosphorus, and ammonia-nitrogen were also measured. The studies indicated that reductions in COD of up to 71% and in BOD of up to 96% were possible. Exothermal processes in the reactor resulted in an effluent temperature of about 25 C, compared to an influent temperature of about 17-18 C. (Baker-FIRL)
W78-05857

HYACINTHS FOR WASTEWATER TREATMENT,
J. Joseph.
Plumbing Engineer, Vol. 5, No. 6, p 14-16, November-December, 1977.

Descriptors: *Water hyacinth, *Biological treatment, *Absorption, *Treatment facilities, *Sewerage, Sewage treatment, Lagoons, Installation costs, Operating costs, Municipal wastes, Waste water treatment.

The use of water hyacinths has been proposed as a low-cost means of waste water treatment. Water hyacinths absorb contaminants from water which can be recovered upon harvesting. The harvested plants can be used as supplemental animal feed or converted into methane and fertilizer by composting. Results from a test facility in Orange Grove, Mississippi, using hyacinths to treat raw sewage from a community of 5000 residents indicate that water hyacinths can be used for final polishing to produce effluent of a quality which complies with advanced waste water treatment standards. A treatment facility designed to use water hyacinths generally consists of treatment lagoons and aeration, filtration, and plumbing equipment. Costs for operation and maintenance are generally low. Waste water is first held in an aerated basin for a two-week period to allow bacterial consumption of the waste water organics. The final filtration lagoon, planted with water hyacinths, can usually be smaller than the aeration basin because of its higher efficiency. The water hyacinth lagoon at Orange Grove, Mississippi, effectively reduces the concentration of suspended solids in effluent by 63-80% and nitrogen by about 60%. (Snyder-FIRL)
W78-05858

LOW-FLOW WASTEWATER TREATMENT.
Rain, Vol. 4, No. 3, p 6-7, December, 1977. 7 fig.

Descriptors: *Domestic wastes, *Treatment facilities, *Low flow, *Sewage treatment, *Ultimate disposal, Volume, Filters, Fertilization, Sewerage, Suspended solids, Seepage, Municipal wastes, Waste water treatment, Waste water disposal.

A simple treatment system for low volumes of waste water with few suspended solids is based on the use of a 30-gal garbage can as a settling tank to trap floatables which would clog the seepage pit. When floatables and grease appear in a 5-gal plastic bucket used as a check tank, the settling tank should be emptied and the contents buried. A sand filter made from a 55-gal drum can be used to treat 25-50 gal of greywater per day. Because sand filters may fail if continually saturated, the alternate use of two filters is recommended. One direct surface application system is designed to retain urine and greywater in a 55-gal drum for use as irrigation water with a fertilizer value. The end of the hose carrying the waste water to the garden is covered by a cloth bag for retention of large particles. Systems have been designed for treating 20-50 gal to greywater daily using tar-covered, 55-gal drums. The leach line for one such system uses a 'V' made of redwood or cedar instead of plastic or tile pipe. A system for reusing greywater is designed to send all sewage directly to the sewer when a valve is closed and to a holding tank when the valve is open. (Snyder-FIRL)
W78-05859

WASTING WATER.
Rain, Vol. 4, No. 3, p 4-5, December, 1977. 1 fig.

Descriptors: *Domestic wastes, *Treatment facilities, *Water conservation, *Organic wastes, *Sewage treatment, Water consumption, Standards, Sewerage, Installation, Municipal wastes, Waste water treatment, Waste water disposal.

Separate treatment of toilet wastes and kitchen garbage of composting can reduce the extent of treatment required for the remaining greywater. Separate treatment and water-conserving measures can reduce domestic waste water treatment needs sufficiently to allow the use of simple treatment systems installed and maintained by the homeowner. These simple systems can cost much less than central septic-leach systems. They typically return water to the water table in small doses. Their disadvantages are generally related to the lack of experience and inadequate standards. Because construction standards vary widely and have a poor compliance record, regulatory agencies are usually reluctant to accept these systems. Treatment requirements for greywater are generally dependent upon the waste water volume, its strength, and the intent for reuse. It is very difficult to determine the nature of health hazards associated with greywater treatment. (Snyder-FIRL)
W78-05860

TRENDS EMERGE, BUT SOLAR DESIGN OPTIONS STILL OPEN,
Modern Metals, Chicago, IL.
For primary bibliographic entry see Field 8C.
W78-05861

SANITARY DISTRICT SOLVES SLUDGE REMOVAL PROBLEM.
For primary bibliographic entry see Field 5G.
W78-05862

DOMESTIC WASTEWATER RECYCLING.
Engineering News-Record, Vol. 199, No. 20, p 54, November, 1977.

Descriptors: *Domestic wastes, *Treatment facilities, *Recycling, Equipment, *Water purification, Water reuse, Biological treatment, Analytical techniques, Demineralization, Filtration, Oxidation, Adsorption, Waste water(Pollution), Waste water treatment, Waste water disposal.

Purecycle, of Boulder, Colorado, has developed a 5-step process for purifying domestic waste water for recycling. The recycling module is controlled and monitored by sensors connected to a microprocessor. The recycling module would be installed outside the house and connected with existing plumbing. It's size is approximately that of a compact car, and its costs will be comparable to those of conventional systems. Household waste water enters a biological reactor for the oxidation of organics; solids are removed by settling. The water then enters a filtration system and an organic adsorption unit, followed by a demineralizer and sterilizer. The microprocessor monitors the system for malfunctions. According to the manufacturer, tests have indicated that the system can produce a constant and safe recycled water supply at reasonable cost. (Snyder-FIRL)
W78-05864

CHEMICAL INTERACTION IN PARTICAL SEPARATION,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
W. Stumm.
Environmental Science and Technology, Vol. 11, No. 12, p 1066-1070, 1977. 8 fig, 8 ref.

Descriptors: *Separation techniques, *Chemical precipitation, *Coagulation, *Adsorption, *Zeta potential, Colloids, Water treatment, Waste water treatment, Suspended solids, Phosphorus, Phosphates.

Chemical interaction in particle separation is discussed with respect to solution variables which may influence the charge of colloidal surfaces. The specific adsorption of Mg(++), H(+), heavy metals, and anions such as SO4(--), HPO4(--), SiO, OH3(-), and OH(-) onto hydrous oxides of Si, Al(+3), and Fe(+3) is examined with respect to the resultant electric charge on the particle surface. The relative efficiencies of particle aggregation in coagulation and particle removal in filtration are compared for natural systems and waste water treatment processes. Mechanisms of phosphate removal during sewage treatment by precipitation with Fe(+3) or Al(+3) salts are discussed. (Baker-FIRL)
W78-05865

FILTER TOWERS AND DISTRIBUTORS FOR LLANDYRNOG SEWAGE TREATMENT WORKS.
Industrial and Metallurgical Equipment Ltd., Croydon (England).
Water Service, Vol. 81, No. 979, p 565, September, 1977. 1 fig.

Descriptors: *Treatment facilities, *Filters, *Biochemical oxygen demand, *Porous media, Equipment, Municipal wastes, Industrial wastes, Waste water treatment.

The use of two filter towers and four motorized Carlton distributors at the Llandyrnog sewage treatment works in Scotland is described. The distributors were designed to provide a 60% reduction in BOD by ADF treatment over Flocor filter media. Two thirds of the influent BOD is contributed by creamery waste and one third by domestic sewage. The initial raw sewage inflow is screened to remove extraneous matter and grit. Pumps are then employed to feed the liquor to the filter tower distributors. The liquor percolates through Flocor media prior to sedimentation. Corrosion-resitant stainless steel distributing arms are design features fo the machines. The motorized Carlton distributors are used for secondary filtration operations on a 19.5-m diam and a 23.35-m diam filter bed. An important feature in the design is the frictionless liquid seal, achieved by immersing the open ends of the pending siphons in the liquid remaining at the bottom of the revolving tank. (Baker-FIRL)
W78-05866

CHLORINATION AND OZONATION IN WATER AND WASTEWATER TREATMENT,
Pennsylvania Univ., Philadelphia. Dept. of Civil and Urban Engineering.
For primary bibliographic entry see Field 5F.
W78-05867

SLUDGE DEHYDRATION BY MEANS OF CHAMBER FILTER PRESS (SLAMAVVANNING MED KAMMERFILTER-PRESSER),
J. O. From.
Teknisk Ukeblad, Vol. 124, No. 5, p 42-44, October, 1977. 2 fig.

Descriptors: *Dewatering, *Sludge treatment, *Filters, *Filtration, *Flocculation, Equipment, Design data, Polyelectrolytes, Lime, Sewage treatment, Waste water treatment.

Principles, advantages, and experimental results on the use of chamber filter presses for dewatering sewage sludge are presented. Chamber filter presses have the advantage of being sturdy, simple to operate, and dependable. They do not require the use of synthetic polyelectrolytes for sludge

conditioning, although ferric chlroide and lime may be used in pretreatment. Sludge from physico-chemical waste water treatment plants can be dewatered in chamber filter presses without liming. The filter cake, with a solids content of 30-40%, can be incinerated directly without further treatment. Experiments in Norway with chamber filter presses operated at a specific load ranging 60-150 liters/sq m/hr produced a filter cake with a solids content ranging 26-35%. Residual solids on the filter cloth could be removed by treatment with hydrochloric acid. (Takacs-FIRL)
W78-05868

FILTERS FOR SCOTTISH SEWAGE PURIFICATION PLANT.
Water Services, Vol. 81, No. 979, p 558, September, 1977.

Descriptors: *Filters, *Dewatering, *Sludge treatment, Equipment, *Municipal wastes, Industrial wastes, Treatment facilities, Filtration, Separation techniques, Sewage treatment, Waste water treatment.

Two rotary drum vacuum filters, manufactured by Stockdale Engineering Ltd of Rockbank, Macclesfield, Cheshire, England, are being used in Scotland to dewater a mixture of primary and secondary sludge at a waste water treatment plant which handles municipal wastes in addition to effluents from a distillery and a vegetable cannery. The sludge, which varies in pH from 4.0 to 11.0, is conditioned by the addition of a slurry of lime and aluminum chlorohydrate. After conditioning, the sludge is fed by gravity to two 300 sq ft Stockdale filters. The resulting filter cake containing about 20% solids is discharged into skips for transport to a landfill. (Schulz-FIRL)
W78-05869

HAYLE VALLEY STW--BIGGEST IN CORNWALL.
Water Services, Vol 81, No 979, p 570-572, September, 1977. 7 fig.

Descriptors: Treatment facilities, *Design data, *Sewage treatment, *Filters, *Sludge treatment, Equipment, Sludge treatment, Municipal wastes, Waste water treatment.

The Hayle valley sewage treatment plant in the West Cornwall area of England was designed to serve a summer population of 37,500 and a winter population of 19,000. Raw sewage is first screened and grit is removed by two 5 m-diam Pista grit traps. The sludge then undergoes primary settling in three 27 m-diam, 3.5 m-deep basins. Effluent from a local creamery, which the plant also treats, is pumped to a 230 cu m holding tank and then to a primary tower filter containing 1200 cu m of Flocor E. Two screw pumps transport the flow to primary humus tanks, secondary biological filters containing granite media, and secondary humus tanks. Sludges are treated with a polyelectrolyte and dewatered by two Manor-Guva tower presses. (Schulz-FIRL)
W78-05870

THE APPLICABILITY OF TRACER TECHNIQUES FOR STUDIES ON SEWAGE TREATMENT PROCESS DYNAMICS,
Technical Research Center of Finland, Esbo.
R. Kuoppamaeki.
International Journal of Applied Radiation and Isotopes, Vol 28, No 10-11, p 833-837, 1977. 2 fig, 34 ref.

Descriptors: *Tracers, *Radioisotopes, *Tracking techniques, *Sewage treatment, Hydraulic properties, Analytical techniques, Aeration, Settling basins, Sludge treatment, Treatment facilities, Municipal wastes.

Radioactive isotopic tracers have been used to label particular elements, solid particles, and sludge for the examination of physical and chemical processes occurring during waste water treatment. The dilution method, the total count method, and the total sample method have been used to measure flow rates in channels or conduits having unknown flow cross-sections. When the flow volume and the degree of mixing between two designated points can be determined, the trace pulse victory method is favored for measuring tube flows. Tracer techniques have been used to study sedimentation basin dynamics, to detect severe hydraulic malfunctions, and to compare sedimentation basin design efficiencies. Radioactive isotopic tracers have been used in the activated sludge process to determine the sludge recycling ratio, circulation time, and mixing requirements. Tracer methods have been developed for measuring the aeration capacity of an acration basin under actual process conditions. (Lisk-FIRL)
W78-05872

PARAMETER ESTIMATION FOR THE FIRST-ORDER BOD EQUATION USING NONLINEAR TECHNIQUES,
Watcrloo Univ. (Ontario). Dept. of Civil Engineering.
T. W. Constable, and E. A. McBean.
Canadian Journal of Civil Engineering, Vol 4, No 4, p 462-470, December, 1977. 7 fig, 5 tab, 14 ref.

Descriptors: *Biochemical oxygen demand, *Waste water treatment, *Decomposing organic matter, *Oxygen demand, *Aerobic treatment, Treatment facilities, Municipal wastes, Bacteria, Waste water disposal.

BOD parameters in waste water were calculated using two nonlinear techniques. The techniques were compared to other estimation methods by application of the techniques to raw sewage and primary effluent from the Waterloo Pollution Control Plant in Ontario, Canada. The first technique used in estimating the parameters in first-order BOD equations was the Reilly discrete Bayesian technique. This method was preferred for calculating BOD parameters in situations where there was a considerable amount of operating data and a relatively small amount of experimental data. The Reilly discrete Bayesian technique, which successfully incorporated prior data into the BOD parameter estimation method, was shown to be satisfactory when other simpler techniques produced inadequate results. The second method of estimating first-order BOD parameters was Marquardt's nonlinear least-squares technique. This algorithm was found to produce results comparable to the Bayesian method and to require less time for computer calculations. While Marquardt's method was considered simpler and less expensive than the Bayesian technique, various problems, such as slow convergence, wide oscillations, and failure to converge, did occur. Two nonlinear techniques tested were considered better than the other techniques which had incorrect error structures. (Lisk-FIRL)
W78-05873

FACTORS AFFECTING EFFLUENT QUALITY FROM FILL-AND-DRAW ACTIVATED SLUDGE REACTORS,
Purdue Univ., Lafayette, IN. Environmental Engineering Lab.
G. T. Daigger, and C. P. L. Grady, Jr.
Journal Water Pollution Control Federation, Vol 49, No 12, p 2390-2396, December, 1977. 1 fig, 4 tab, 12 ref.

Descriptors: *Activated sludge, *Chemical oxygen demand, *Suspended solids, *Hydraulic systems, *Influent streams, Effluent streams, Biological treatment, Microbial degradation, Waste water treatment, Municipal wastes.

The concentration of soluble organic matter in effluent treated by the activated sludge process was compared with the concentration of organic matter in waste water before treatment. The influence of hydraulic residence time on the quality of the effluent was also observed. Experiments were conducted using plug-flow activated sludge reactors with influent lactose concentrations ranging from 600-3,600 mg/liter. Hydraulic residence times were held constant at 46 hours with the fill-and-draw cycle occurring every 24 hours. Daily samples were analyzed for suspended solids, volatile suspended solids, pH, COD, and lactose. Soluble COD concentrations in the effluent were found to be directly related to the soluble COD content of the influent. This proportional influence of influent concentration on effluent quality in a plug flow activated sludge system was found to be the same result as obtained in experiments with completely-mixed processes. Soluble COD in the effluent was produced by microbial action during the activated sludge process. It was concluded that the COD concentration of the influent determined the effluent quality, regardless of the hydraulic process, and that the activated sludge method not only used organic matter, but produced it as well. The effect of the hydraulic residence time on effluent quality could not be determined. (Lisk-FIRL)
W78-05875

MEMBRANE SEPARATION PROCESS--PRINCIPLES, PRACTICE, AND PROSPECTS,
Aberdeen Univ. (Scotland). Dept. of Chemistry.
P. Meares.
Interdisciplinary Science Reviews, Vol 2, No 4, p 327-336, 1977. 2 fig, 6 tab, 21 ref.

Descriptors: *Membrane processes, *Separation techniques, *Electrodialysis, *Reverse osmosis, *Desalination processes, Ion exchange, Permselective membranes, Cation exchange, Anion exchange, Bonding, Gases, Membranes, Waste water treatment, Polymers, Pores, Permeability.

Various membrane processes for separation at the molecular level and for desalination, hyperfiltration, waste water treatment, and gas separation are discussed. Some polymers and rubber-like elastomers have varying molecular chain configurations which allow the pore size to change. Rigid polymers with crystalline molecular chains and pores less than five nanometers in diameter are formed by the combination of a cationic and an anionic polyelectrolyte or by combined solvent and non-solvent casting. These rigid polymers, which can become plasticized by large quantities of permeants, allow small molecules to penetrate the pores but exclude the macromolecules, making these membranes useful in dialysis and ultrafiltration. The primary processes of desalination are reverse osmosis and filtration with gel membranes used in electrodialysis and piezodialysis. Hyperfiltration with cellulose acetate membranes is effective in desalination but could be improved by the development of less bulky polymer chains and hydrogen-bonding groups. Desalination through electrodialysis utilized cationic and anionic exchange resins and electric generation. Polarization and organic fouling of the membranes inhibit the effectiveness of electrodialysis. Piezodialysis, regarded as the best method for desalination, utilizes ion and water flow coupling, and allows salt to permeate the membrane under pressure while water is absorbed. The most permeable polymer in use for separation of nitrogen and oxygen from gaseous products was found to be a dimethyl silicone membrane. While permeability was high in comparison with other membranes, selectivity was low. (Lisk-FIRL)
W78-05877

A MICRO-KJELDAHL TECHNIQUE FOR NITROGEN DETERMINATION IN WATER, WASTEWATER, AND SLUDGE,
Butler, Fairman and Scufert, Inc., Carmel, IN.
For primary bibliographic entry see Field 5A.

W78-05878

INFLUENCE OF ARTIFICIAL DRAINAGE ON PENETRATION OF COLIFORM BACTERIA FROM SEPTIC TANK EFFLUENTS INTO WET TILE DRAINED SOILS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W78-05881

PHOTOTROPHIC PURPLE AND GREEN BACTERIA IN A SEWAGE TREATMENT PLANT,
Institut fuer Mikrobiologie der Gesellschaft fuer Strahlenund Umweltforschung mbH, Goettingen, West Germany.
E. Siefert, R. L. Irgens, and N. Pfenning.
Applied and Environmental Microbiology, Vol. 35, No. 1, p 38-44, January, 1978. 2 fig, 5 tab, 19 ref.

Descriptors: *Activated sludge, *Phototropism, *Sulfur bacteria, *Sewage bacteria, *Metabolism, Aerobic conditions, Anaerobic conditions, Light penetration, Anaerobic bacteria, Waste water treatment, Sampling, Analytical techniques, Municipal wastes.

The content and metabolism of phototrophic bacteria in waste water purification processes were investigated in laboratory experiments with effluent from the Goettingen, West Germany, sewage treatment plant. Phototrophic bacteria were evident in every stage of the treatment process; the bacteria count was highest in sludge-bearing waste water. Colony counts of purple nonsulfur bacteria in all stages of waste treatment ranged 100-650,000 colonies/ml of waste. Purple and green sulfur bacteria colony counts ranged 0-1,300/ml. The quantity of bacteriochlorophyll, synthesized by the purple nonsulfur bacteria, in activated sludge samples was found to be 5-10 times higher than the calculated production for the bacteria colony count. It was concluded that phototrophic bacteria continue to grow in a reduced oxygen environment. The reduction of light in activated sludge layers was not a growth-limiting factor for phototrophic bacteria. It was assumed that the bacteria continue to grow through respiratory energy at low oxygen concentrations. Phototrophic bacterial growth was limited, but not eliminated under anaerobic and dark conditions. Growth continued by fermentative energy metabolism, but not efficiently enough to allow competition with chemotrophic anaerobes. Although not considered as efficient as chemotrophic bacteria in waste water treatment, phototrophic bacteria had the advantage of assimilating inorganic minerals and producing cell protein as a byproduct. An example of waste water treatment with phototrophic bacteria in Japan was cited. (Lisk-FIRL)
W78-05883

DETERMINATION OF CHLORINE DIOXIDE IN SEWAGE EFFLUENTS,
Wastewater Technology Center, Burlington (Ontario).
For primary bibliographic entry see Field 5A.
W78-05884

DISPOSAL OF INDUSTRIAL EFFLUENT CONTG. SALTS AND ORGANIC MATTER ARISING PARTIC. FROM MFG. WEEDKILLER AND INSECTICIDES.
Netherlands Patent NL 7704-214. Issued November 21, 1977. Derwent Netherlands Patents Report, Vol. Y, No. 49, p 3, January, 1978.

Descriptors: *Salts, *Organic matter, *Insecticides, *Chemical industry, *Patents, Incineration, Evaporation, Separation techniques, Chemical wastes, Desalination, Waste water treatment, Industrial wastes, Herbicides.

A patent has been issued for a process for the removal of salts and organic materials from weed-killer and insecticide manufacturing effluents. The waste water is connected through evaporation and introduced into a directly fired combustion chamber. Organic materials in the waste are decomposed and the physical state of the salts is transformed. The concentrate is converted to a powder by spray drying with hot gas; the powder is pneumatically transferred to a combustion chamber. The powdered salts ae vaporized and removed by the hot gases produced during the incineration of the organic matter. Salt is separated from the hot gases by rapid cooling; the waste gas, containing volatile organic matter, is incinerated with an additional fuel source. Energy produced during combustion is supplied to the spray drier as a source of heat and to a boiler which produces steam for the evaporation process. Salt corrosion of heat transfer surfaces was reduced by elimination of the combustion chamber gases exhausted to the waste heat boiler. (Lisk-FIRL)
W78-05885

A STUDY OF THE POSSIBLE USE OF ION-EXCHANGE RESINS IN TEXTILE WASTE-WATER TREATMENT, (IN RUSSIAN),
Gruzinskii Politekhincheskii Inst., Tiflis (USSR).
V. D. Eristavi, G. S. Mamatsashvili, Ts. S. Kurtskhaliya, and A. V. Shvangiradze.
Soobshch Akad Nauk Gruz Ssr 85(2), p 385-388, 1977.

Descriptors: *Waste water treatment, *Ion exchange, Resins, Sewage effluents, Domestic wastes, *Textiles, Industrial wastes.

In order to study the reduction of water resources pollution from domestic and industrial effluents, the sorption abilities of some home-produced anionites in Cl-form and the determination of the optimal conditions of azodye ion sorption are discussed. The optimal concentration of the azodye operating solution was 0.005 g/l and the filtration rates was 2 l/h, the total exchange capacity of the ionites being 2.5-3 mg/eq/g. Under optimum conditions 1 g of dry ionite purifies 100 l of waste water, with the optical density of purified water being d = 0.--Copyright 1978, Biological Abstracts, Inc.
W78-05886

PARTICIPATION OF MICROORGANISMS IN THE PURIFICATION OF SEWAGE FROM CYANIDES, (IN RUSSIAN),
Akademiya Nauk Kazakhskoi SSR, Ama-Ata. Inst. of Microbiology and Virology.
A. N. Ilyaletdinov, P. B. Enker, and Z. G. Vlasova.
Mikrobiologiya 46(2), p 358-362, 1977.

Descriptors: *Microorganisms, *Cyanides, Water purification, Industrial wastes, *Waste water treatment, *Oxidation-reduction potential.

Microorganisms can decrease in the concentration of cyanides in water in the presence of organic C in the medium without additional N sources. N inhibits assimilation of cyanide N by microorganisms. The concentration of cyanides decreases faster in aerobic conditions at higher values of the redox potential of the medium. The process may be used for purifying industrial sewage from cyanides.--Copyright 1978, Biological Abstracts, Inc.
W78-05889

SALMONELLA AND BACTERIAL INDICATORS IN OZONATED AND CHLORINE DIOXIDE-DISINFECTED EFFLUENT,
Ontario Ministry of Health, Toronto.
For primary bibliographic entry see Field 5A.
W78-05890

MASS TRANSFER IN THE LIQUID PHASE WITH TUBULAR WASTE-WATER TREATMENT CONTRACTOR,
Tokyo Inst. of Tech. (Japan). Research Lab. of Resources Utilization.
K. Fujie, T. Sekizawa, and H. Kubota.
Journal of Fermentation Technology, Vol 55, No 5, p 532-543, 1977. 11 fig, 3 tab, 5 ref, 1 append.

Descriptors: *Mass transfer, *Dissolved oxygen, *Microorganisms, *Waste water treatment, *Organic substances, Model studies, Separation techniques, Treatment facilities, Waste disposal, Municipal wastes.

The effect of mass transfer on the removal of organic substances from waste liquid by a biological filter was examined in laboratory experiments employing a microbial film attached to a tubular contactor. Honeycomb and parallel plate supporters were used as tubular contractors. The microbial film was established by the circulation of a nutrient solution containing a high percentage of glucose through the supporters for several days. Simulated waste water, also containing glucose, was passed through the supporters on which microbes had grown. Rate controlling factors were determined through observation of liquid flow rates, the mass transfer resistance of organic substances or dissolved oxygen removal by the microbial film, and resistances of organic or dissolved oxygen diffusion. Honeycomb and parallel plate supporters with more complicated liquid flow routes produced higher glucose removal rates through the elimination of the effects of the liquid flow velocity. The effect of mass transfer was eliminated for the liquid phase as it was based on the liquid flow rates; the reaction rate controlling step was transferred to the microbial film. The dissolved oxygen concentration was shown to directly affect the reaction in the microbial film. (Lisk-FIRL)
W78-05892

THE DEVELOPMENT OF HETEROTROPHIC BACTERIA IN CIRCULATING WATER SYSTEMS, (IN RUSSIAN),
Vsesoyuznyi-Nauchnyi Planovii Otdel Tsellyulozno-Bumazhnoi Promyshlennost, Leningrad (USSR).
For primary bibliographic entry see Field 5C.
W78-05893

NEW APPROACH TO BACTERIAL KINETICS IN WASTEWATER,
Syracuse Univ., NY. Dept. of Chemical Engineering and Materials Science.
For primary bibliographic entry see Field 5C.
W78-05894

THE USE AND INTEGRATION OF GROUND AND SURFACE WATER MODELS IN THE 208 PLANNING PROCESS,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5B.
W78-05895

CONVERTING WASTES TO ENERGY--A CONCEPTUAL APPROACH,
Nihon Suido Consultants Co. Ltd., Tokyo.
Y. Chiu, and W. Guey-Lee.
Water and Sewage Works, Vol. 125, No. 2, p 44-47, February, 1978. 2 fig, 1 tab, 15 ref.

Descriptors: *Thermal power, *Model studies, *Sludge digestion, *Methane, *Hydraulic structures, Electric power production, Electric power-plants, Electric power demand, Water demand, Recirculated water, Waste water treatment, Municipal wastes, Treatment facilities.

A mathematical model was developed for thermal energy recovery, water reuse, steam generation, and methane gas production during sludge

digestion of municipal wastes. The study was performed for a municipal area with a population of one million, producing 6 lb sewage/capita/day. The electric energy production rate from the municipal wastes in a high rate digester was calculated as 180,000 kw/day with a waste heat production of 960 Btu/hr. The total daily energy requirement for a population of one million was calculated to be 880,000 kw, indicating the need for an additional 6,000 tons of coal daily to supply the demand. The required digester capacity for a digestion temperature of 90F, based on the total available waste heat, was calculated to be 100,000,000 cu ft. Based on a per capita water requirement of 160 gal/day, a water reuse loop system would provide 60% of the daily water demand by the municipality. Controlling factors in the production of fuel gas include: detention time; the percentage of methane in the digester gas; and the digestion temperature, which decreases detention time and methane percentage when it is increased but also increases heat requirements. (Lisk-FIRL)
W78-05896

PURIFICATION OF SECONDARY EFFLUENT IN A NATURAL SAND FILTER,
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Environmental Engineering.
D. B. Aulenbach, R. R. Harris, and R. C. Reach.
Journal Water Pollution Control Federation, Vol. 50, No. 1, p 86-94, January, 1978. 4 fig, 3 tab, 9 ref.

Descriptors: *Sand aquifers, *Nitrates, *Phosphorus, *Copper, *Coliforms, Biochemical oxygen demand, Chemical oxygen demand, Chlorides, Seepage, Filtration, Lysimeters, New York, Waste water treatment, Municipal wastes, Tertiary treatment.

Depths at which secondary effluent contaminants are removed by a natural sand bed filter were determined with seepage samples from observation wells and lysimeters installed at the rapid infiltration sites used by the Lake George Village, New York, Sewage Treatment Plant. Secondary effluent from trickling filters was applied to 21 sand filtration beds covering a total area of 5.4 acres. Samples in the 20-meter sand filter were collected with lysimeters at depths of 3, 7, 11, and 18 meters. Analyses of the samples indicated that coliforms, BOD, COD, orthophosphate, ammonia nitrogen, and organic nitrogen were completely removed and nitrate-nitrogen levels were reduced to approximately 8 mg/liter. Chlorides and other soluble substances passed through the sand filter unchanged. Nitrate removal increased with depth of passage through the filter and almost complete nitrate removal was achieved by a depth of 18 meters. Orthophosphate was reduced to less than 0.1 mg/liter within the first 10 meters; total phosphate reductions decreased with depth. Phosphate levels decreased to less than 0.1 mg/liter during the spring. Copper concentrations were below 0.05 mg/liter for all samples analyzed. Levels of calcium, magnesium, alkalinity, iron, sodium, and potassium were also monitored. (Lisk-FIRL)
W78-05902

THE IMPACT OF WATER SAVING WATER CLOSETS ON BUILDING DRAINS AND SEWERS,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 3D.
W78-05904

CANNING GROUP EXPANSIONS.
Water Services, Vol 81, No 980, p 598-599, October, 1977.

Descriptors: Organizations, *Chemicals, *Laboratories, *Pumps, *Treatment facilities, Europe, Chemical industry, Flocculation, Analytical techniques, Sewage treatment, Water treatment, Municipal wastes, Industrial wastes, Waste water treatment.

In October 1976 when Water Management Limited became part of the Canning Group, it became apparent that larger premises would be needed for construction of water treatment facilities and production of Water Management speciality chemicals for water conditioning. Larger manufacturing operations were established in Kidderminster, together with laboratories for their water treatment and conditioning consulting service. A complete analytical laboratory was made available, along with flocculents for water and sewage treatment and Vortex Oil Drinkers to remove floating oil from water. All products of the Canning Group will be available in France, including treatment equipment for industrial effluents and public water supplies. The European marketing activities will be controlled through Canning International BV, Amsterdam. Penguin Pumps Limited jointed the Canning Group in 1970 as a subsidiary of Canning effluent treatment specialists, Pollution Control Limited. The present move brings together the group's pump manufacturing activities. In the near future the group will manufacture some pumps made entirely of plastic for handling chemicals over a wide temperature range. (Snyder-FIRL)
W78-05908

POLLUTION CONTROL PLANT STATISTICS.
For primary bibliographic entry see Field 5G.
W78-05909

COST-EFFECTIVENESS OF ON-SITE AND COMMUNITY SEWERAGE ALTERNATIVES,
Brown and Caldwell, Eugene, OR.
J. J. Troyan, and D. P. Norris.
Civil Engineering-ASCE, Vol 47, No 12, p 84-89, December, 1977. 3 tab.

Descriptors: *Cost-benefit analysis, Economics, *Sewerage, *Feasibility studies, *Project planning, Sewage treatment, Cost comparisons, Septic tanks, Sewers, Sewage disposal, Environmental effects, Soil analysis, Municipal wastes, Waste water treatment.

Information pertinent to the cost-effectiveness analysis of sewerage systems for small communities and rural residential areas is presented. Selection criteria are established for eight alternative systems for on-site disposal and community collection, including: septic tank-soil absorption system, septic tank-mound system, septic tank-evaporation-transpiration system, conventional gravity sewers, small-diameter gravity sewers, pressure sewers, and vacuum sewers. The feasibility analyses are based upon results of an inventory of soils, site characteristics, geology-hydrology, and climate. The inventory results are evaluated in conjunction with data on technical feasibility, environmental regulations, and unit costs. Advantages, disadvantages, and limitations of the on-site disposal and community collection systems are described. (Schulz-FIRL)
W78-05910

PHOSPHORUS DYNAMICS IN SOILS IRRIGATED WITH MUNICIPAL WASTEWATER,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
L. E. Sommers, D. W. Nelson, L. B. Owens, and M. Floyd.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 609, Price codes: A04 in paper copy, A01 in microfiche. Technical Report No 99, December 1977. 64 p, 25 fig, 23 tab, 50 ref. OWRT B-075-IND(2).

Descriptors: *Wastewater disposal, *Irrigation, *Phosphorus, Waste water treatment, Soil disposal field, *Irrigated wastewater, Phosphatase enzymes, Equilibrium.

A cooperative study was conducted with Pennsylvania State University to assess the effects of wastewater irrigation on soil P. relations. The major objectives were to evaluate the influence of wastewater irrigation on (1) changes in soil C, N, and P; (2) sorption of inorganic P by soils; and (3) properties of phosphatase enzymes in soil. Soil samples were obtained from Hublersburg silty clay loam cropped to corn, Reid Canarygrass and a mixed forest and from a Morrison sandy loam with a mixed forest stand. The sites had been irrigated with secondary effluent for 11-12 years. Soil analyses indicated that the majority of P added to the soils remained in the upper 30 cm of the Hublersburg soil, while appreciable amounts of P leached to 30-60 cm in the Morrison. The equilibrium P. concentration increased as a result of the wastewater irrigation and the P sorption capacity decreased. A comparison of soluble P levels in leachate collected at a 120 cm depth with soluble P predicted by EPC measurements indicated laboratory measurements overestimated the ability of a soil to remove P from wastewater. (Wiersma-Purdue)
W78-05937

METHODOLOGY FOR ANALYZING EFFECTS OF URBANIZATION ON WATER RESOURCE SYSTEMS,
Texas Univ. at Austin. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5C.
W78-05938

A MODIFIED PERCHLORINATION PROCEDURE FOR THE DETERMINATION OF POLYCHLORINATED BIPHENYLS,
Wisconsin Univ.-Madison. Water Chemistry Lab.
For primary bibliographic entry see Field 5A.
W78-05939

INFECTIOUS HOSPITAL WASTES: THEIR TREATMENT AND SANITARY DISPOSAL,
Florida Univ., Gainesville. Dept. of Chemical Engineering.
S. S. Block, and J. C. Netherton.
p 723-739, 3 fig, 3 tab, 44 ref. In: Disinfection, Sterilization, and Preservation, Block, S. S. (ed.), Lea and Febiger, Philadelphia, Pennsylvania, 1977.

Descriptors: *Waste water treatment, *Municipal wastes, *Hospitals, *Sewage treatment, *Pollutant identification, Sewerage, Biochemical oxygen demand, Chemical oxygen demand, Treatment facilities, Solid wastes.

The increased use of disposable items has increased the quantity of solid waste generated by hospitals. Hospital waste may be finely ground and discharged to a sewage treatment plant, incinerated, or landfilled. Wet grinding before discharge to the municipal sewage system is being considered for total hospital solid wastes. Tests for chloride, BOD, and COD revealed no significant changes in the sewage as a result. Most plastic and related materials should settle out or be removed during primary treatment. The waste should have little effect on the public health characteristics of the sewage, since material from bioscience laboratories is disposed of by grinding. Hospitals that use landfilling for most wastes generally use an incinerator for pathogenic wastes. Complete sterilization of incinerated wastes requires a proper combination of air temperature, firebrick temperature, and retention time. Land disposal may expose the community to hospital waste contaminants, with the greatest potential of exposure arising from a disposal site where water pollution by runoff or leaching may occur. Wastes should be ground and sterilized before land disposal. High fecal coliform densities sampled from a landfill (2000 to 4,900,000 organisms per 100 ml) indicate potential health effects during the first 2-month leaching period. The absence of pathogens in the leachate confirms that pathogens are inactivated by heat in the landfill. (Snyder-FIRL)
W78-05949

EVALUATION OF NEW REVERSE OSMOSIS MEMBRANES FOR THE SEPARATION OF TOXIC COMPOUNDS FROM WASTEWATER,
Illinois Univ. at Urbana-Champaign. Dept. of Environmental Engineering.
E. S. K. Chian, M. N. Aschauer, and H. H. P. Fang.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A030 884, Price codes: A14 in paper copy, A01 in microfiche. Army Medical Research and Development Command, Washington, D.C., Final Report UILU-ENG-75-2028, June 1976. 323 p, 69 fig, 56 tab, 122 ref, 5 append.

Studies with NS-100 and aromatic polyamide membranes were conducted in an attempt to select reverse osmosis membrane materials for use in the treatment of waste water from army field hospitals. Mathematical models were formulated for optimizing the casting conditions for flat sheet NS-100 membranes. Membrane performance was predicted under various operating conditions. NS-100's surface structure was related to its capacity to retain organic compounds using a simple test with a sodium chloride solution. The potential application of both NS-100 and aromatic polyamide membranes, including B-9 and B-10 permeators, was examined for other waste water types. An additional objective was to evaluate the engineering parameters involved in applying NS-100 membranes to the treatment of waste water. Casting techniques for tubular NS-100 membranes were also refined. NS-100's chemical resistance to oxidants and the effects of additives on membrane performance were evaluated. A computer program was developed for use in the design of large treatment plants using the results from tests on single tubes or tubular membrane modules. (Snyder-FIRL)
W78-05950

USE OF A NATURAL MARSH FOR WASTEWATER POLISHING,
Wisconsin Univ.-Oshkosh.
C. W. Fetter, Jr, W. E. Sloey, and F. L. Spangler.
Journal Water Pollution Control Federation, Vol. 50, No. 2, 1978, p 290-307, 13 fig, 10 tab, 22 ref. EPA S-801042 and R-803794.

Descriptors: *Water quality, Water pollution, *Waste water disposal, Waste water treatment, *Marshes, Pollutants, Waste disposal.

The water quality response of a highly polluted stream flowing through a natural marsh is investigated. The stream was studied for a 15-month period. During low-flow periods as much as 50% of the monthly streamflow is discharge from a waste-water treatment plant. The stream receives mixed urban-agricultural runoff and even above the treatment plant outfall contains significant amounts of pollutants. During passage through the marsh there is significant improvement in water quality. There are reductions in concentrations of BOD (80.1%), coliform bacteria (86.2%), nitrite (51.3%), COD (43.7%), SS (29.1%), total phosphorus (13.4%), and orthophosphate (6.4%). It was concluded that natural marshes offer an opportunity to polish wastewater through physical, chemical, and biological reactions in the marsh. (Chilton-ORNL)
W78-05960

PROCEDURES FOR ESTIMATING DRY WEATHER POLLUTANT DEPOSITION IN SEWERAGE SYSTEMS,
Energy and Environmental Analysis, Inc., Boston, MA.
For primary bibliographic entry see Field 5B.
W78-05984

MUSKEGON, MICHIGAN INDUSTRIAL-MUNICIPAL WASTEWATER STORAGE LAGOONS: BIOTA AND ENVIRONMENT,
Northeast Michigan Council of Governments, Gaylord.
W. R. Frykberg, C. Goodnight, and P. G. Meier.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 496, Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA - 600/3-77-039, April, 1977. 78 p, 9 fig, 10 tab, 88 ref. 04J1P01534.

Descriptors: Lagoons, Liminology, *Waste treatment, *Municipal wastes, *Oxidation lagoons, Industrial wastes, Waste storage, *Succession, Plankton, Zooplankton, Phytoplankton, Protozoa, Waste disposal, Sewage disposal, Biological communities, Pollutant identification, *Municipal wastes, *Waste water storage lagoons, Ecological succession, Stabilization ponds, Transparency.

Results of a 2-year limnological study which began shortly after construction of the largest U.S. industrial-municipal wastewater storage lagoon are reported. The biological community was critically examined to document ecological succession; physical and chemical parameters were monitored during the initial filling period. Generally, the lagoons remained aerobic (except for a few weeks during ice-cover), well-mixed vertically, and slightly alkaline pH about 7.7. Phytoplankton-protozoan assemblage was extreamely variable in terms of total abundance and distribution; populations ranged from less than 20 to more than 22,000 units/ml. Chlorophyta were dominant algae except for several weeks each summer when Cyanophyta reached bloom proportions. The zooplankton community was composed of 14 species of free living crustaceans and 4 species of rotifers. Three species of Daphnia (the dominant zooplankton) were routinely collected. Cyclops vernalis was the most common cyclopoid copepod while Daiptomus was the only calanoid copepod recovered. Transparency, measured by a secchi disk, was shallow and averaged about 20 cm, limiting the photoplankton population and excluding rooted aquatics and benthic algae. Benthic fauna was very limited and remained below 100 organisms/0.1 cu m in 95% of the samples. Midges (Chironomidae) accounted for virtually all of the sparse population; Procladius culiciformis and Glyptotendipes barbipes were the most common benthic forms. Sparcity of this population can be attributed to stressed lagoon environment where cncentrations of several metals, notably zinc, were relatively high. BOD 5, chlorophyl a, and primary productivity are reported (Seip - IPA)
W78-05986

HANDLING AND DISPOSAL OF SLUDGES FROM COMBINED SEWER OVERFLOW TREATMENT, PHASE I - CHARACTERIZATION,
Envirex, Inc., Milwaukee, WI. Environmental Sciences Div.
For primary bibliographic entry see Field 5E.
W78-05987

THE COST OF REMOVING CHLOROFORM AND OTHER TRIHALOMETHANES FROM DRINKING WATER SUPPLIES,
Environmental Protection Agency, Cincinnati, OH. Office of Research and Development.
For primary bibliographic entry see Field 5F.
W78-05988

RECOVERY OF LIME AND MAGNESIUM IN POTABLE WATER TREATMENT,
Black, Crow and Eisdness, Inc., Montgomery, AL.
For primary bibliographic entry see Field 5F.
W78-05990

VIRUS PARTICLE AGGREGATION AND HALOGEN DISINFECTION OF WATER SUPPLIES,
North Carolina Univ. at Chapel Hill.
For primary bibliographic entry see Field 5F.
W78-05991

EXPERIMENTAL EVALUATION OF OXYGEN AND AIR ACTIVATED SLUDGE NITRIFICATION SYSTEMS WITH AND WITHOUT PH CONTROL,
District of Columbia Dept. of Environmental Services, Washington. EPA-DC Pilot Plant.
J. A. Heidman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-262 197, Price codes: A04 in paper copy, A01 in microfiche. Report No. EPA - 600/2-76-180, October, 1976. 57 p, 14 fig, 22 tab, 13 ref. 68-03-0349.

Descriptors: Waste water treatment, Municipal wastes, *Activated sludge, *Nitrification, *Oxygenation, *Hydrogen ion concentration, *Ammonia, *Sewage treatment, *Sludge treatment, Effluents, Lime, Oxygen, Oxygen activated sludge systems, Air nitrification, Oxygen nitrification, pH control, Secondary sludge treatment, Mixed liquor suspended solids, Mixed liquor volatile suspended solids, Sludge retention time, Lime dosage, Settling velocity.

The ammonia nitrification capabilities of 2 oxygen activated sludge systems receiving District of Columbia secondary effluent at a steady state flow of 190 cu m/day (50,000 gal/day) were evaluated. The pH of one system was controlled to maintain a pH of 7.0 in the last reactor pass of the 4-pass system. The pH of the second system was uncontrolled and reactor pH values of 5.5-6.0 were common. The effluent quality of the oxygen nitrification system with pH control was excellent; effluent NH4-N concentration averaged about 0.2 mg/l. Effluent NH4-N for the same system without pH control was 1 mg/l or less; however, this system did not show the stability that was achieved with pH control. Parallel air and oxygen nitrification systems, both with pH control to 7.0 in the last reactor pass of each system, were compared under similar operating conditions. Comparison parameters included effluent quality, sludge settling rates, lime dosage, sludge production, and nitrification kinetic rates. The carbonaceous and nitrogenous effluent quality of the air and oxygen systems was identical; but three times the lime disage was required in the oxygen system, resulting in a larger percentage of inert material and increased sludge production. The oxygen system also required maintenance of higher mixed liquor suspended solids (MLSS) levels to achieve the same mixed characteristics of the oxygen sludge compensated for the increased solids loading to the clarifier. Both systems produced excellent effluent quality. (Seip-IPA)
W78-05992

MANUAL OF TREATMENT TECHNIQUES FOR MEETING THE INTERIM PRIMARY DRINKING WATER REGULATIONS.
Environmental Protection Agency, Cincinnati, OH. Office of Research and Development.
For primary bibliographic entry see Field 5F.
W78-05994

STUDIES ON THE PURIFICATION OF WASTES FROM THE NITROGEN FERTILIZER INDUSTRY BY INTENSIVE ALGAL CULTURES. IV. GROWTH OF CHLORELLA VULGARIS IN WASTES WITH HIGH NITROGEN CONTENT IN CONTINUOUS AND INTERMITTENT LIGHT,
Warsaw Univ. (Poland). Dept. of Environmental Microbiology.
K. Matusiak, R. Mycielski, M. Blaszacvk, and A. Bisz-Konarzewska.
Acta Microbiologica Polonica, Vol. 26, No. 1, p 79-93, 1977. 12 fig, 4 tab, 8 ref.

Descriptors: *Water purification, *Nitrogen compounds, *Chlorella, *Algal nitrogen control, Ureas, Nitrogen fertilizer industry, Fertilizers, Ammonification, Nitrogen cycle, Waste treatment.

Growth of Chlorella vulgaris in wastes resultant from urea production was studied. Purification of nitrogen wastes by intensive algal cultures can, besides removing nitrogen, also yield considerable amounts of biomass with up to 50% protein content. In urea waste containing 1260 mg ammonia nitrogen/l, 6240 mg urea nitrogen/l, and 31 mg phosphorus/l only Chlorella vulgaris strain AA could grow. Exposure to wastes containing 1380 mg ammonia nitrogen/l and 6270 mg urea nitrogen/l for 19 days followed by exposure to wastes containing 1750 mg ammonia nitrogen/l and 4340 mg urea nitrogen/l resulted in a constant drop of Chlorella vulgaris cell numbers. Viabil ity of the culture decreased after 15 days and again after 28 days of exposure to the solution. In contrast, the number of Chlorella vulgaris strain AA cells stabilized at a level that was inversely proportional to ammionia nitrogen concentration in the introduced waste. In wastes with lower nitrogen concentrations (820-1250 mg ammonia nitrogen/l) in which Chlorella vulgaris AA culture was placed, ammonia nitrogen was not removed at all or was removed in very small amounts, and only 380-750 mg/l urea nitrogen was removed, depending on the series of wastes. Experiments using various ratios of light and darkness to measure their effect on the cell number and dry weight of the culture showed that best growth was obtained by alternate one hour periods of light and darkness. (Harris-Wisconsin)
W78-05997

NITROGEN OXIDATION AND REMOVAL EFFICIENCY USING ACTIVATED ALGAE,
Pennsylvania State Univ., University Park. Dept. of Civil Engineering.
R. W. Regan, and R. E. McKinney.
Progress in Water Technology, Vol. 8, No. 4/5, p 451-466, 1977. 9 fig, 4 tab, 12 ref.

Descriptors: *Activated algae, *Waste water treatment, *Nutrient removal, *Nitrogen, *Algae, Oxidation lagoons, Flocculation, Aerobic bacteria, Bacteria, Light, Organic loading, Solid wastes, Sewage treatment.

The use of activated algae for waste treatment, in which flocculated algae are separated from the effluent and returned to the process vessel, has been under study at Kansas University since 1965. This paper investigates the operating limits of the process in treating domestic wastewater with activated algae in stabilization ponds. Control parameters included light availability, organic loading rate, and solids residence time for various treatment objectives including nitrogen oxidation and removal efficiency. The basic condition for using activated algae as a secondary-tertiary treatment process is establishment of a symbiotic relationship between algae and aerobic bacteria. In this study it was found that, under high rate conditions, nitrogen levels were controlled by autotrophic oxidation, and photosynthetic and heterotrophic assimilation kinetics. Conclusions were that: (1) Light availability controls algal growth and limited organic load for effective operation; activated algae apparently must be grown in a shallow system with daylight controlling basic reactions. Maximum growth occurred at 43 cm with a COD loading rate of 1600-1800 mg/l/day. (2) Nitrogen removal rates for synthesis, ranging from 0.34-0.112 g N/g VSS, appeared to be limited to assimilative requirements. Organic nitrogen of the mixed liquor solids averaged 13.3%. (3) The growth rate of activated algae microbes and autotrophic nitrifers became limited at SRT values of one and two days respectively. (4) Nitrification decreased alkalinity at 7.1 g as CaCO3 mg/l of ammonia nitrogen metabolized. (Lynch-Wisconsin)
W78-06001

DYNAMICS OF WATER-SOLUBLE SALTS IN SOIL IRRIGATED WITH SEWAGE WATER,
I. A. Vlasyuk, and T. L. Salo.
Pochvovedenie 4, 132-135, 1977.

Descriptors: *Irrigation practices, Water reuse, Sewage, *Waste water disposal, Crop production, Salt tolerance, *Toxic salts, *Grasses, Perennial grasses, Salts, *Toxicity.

Irrigation with sewage water considerably increases yields of perennial grasses (100-250 hkg/ha), but a tendency toward solonetization and accumulation of toxic salts was observed. To prevent salinization, optimal regimes of irrigation and complex farming practices must be used.--Copyright 1978, Biological Abstracts, Inc.
W78-06010

TURBINE ASPIRATION FOR OXYGEN SUPPLEMENTATION,
Alabama Univ., University. Dept. of Engineering Mechanics.
For primary bibliographic entry see Field 5G.
W78-06017

A PROPOSED MODIFICATION TO THE CLASSICAL METHOD OF CALCULATING ALKALINITY OF NATURAL WATERS,
Auburn Univ., AL.
For primary bibliographic entry see Field 5A.
W78-06019

HYGIENIC ASSESSMENT OF BIOLOGICAL FISH PONDS USED FOR PURIFICATION OF SEWAGE FROM LIVESTOCK FARMS, (IN RUSSIAN),
All Union Research Inst. of Animal Husbandry, Dubrovitsy (USSR).
A. N. Ivanov, Yu. A. Koltypin, and E. A. Tarasov.
Gig Sanit 7, p 99-100, 1976.

Descriptors: *Public health, *Biological treatment, *Farm wastes, Sewage, Waste water treatment, Coliforms, Helminths, Swine wastes.

An experimental 4-stage biological pruification system for liquid manure sewage was implemented. Changes in indices from initial input to final outflow were noted for odor, transparency, pH, alkalinity, suspended particles, acidity, biochemical O2 demand, soluble O2, N-compounds, phosphates, coliform titer and helminth eggs. Results indicated that swine sewage can be effectively purified by this system which can also be used for commercial fish production.--Copyright 1978, Biological Abstracts, Inc.
W78-06032

A FIELD STUDY OF THE AGRICULTURAL USE OF SEWAGE SLUDGE: III. EFFECT ON UPTAKE AND EXTRACTABILITY OF SLUDGE-BORNE METALS,
Ball State Univ., Muncie, IN. Dept. of Natural Resources.
K. A. Kelling, D. R. Keeney, L. M. Walsh, and J. A. Ryan.
Journal of Environmental Quality, Vol. 6, No. 4, p 352-358, October-December, 1977. 7 tab, 27 ref.

Descriptors: *Pollutant identification, *Cultivated lands, *Sewage sludge, *Sludge disposal, *Fertilization, Absorption, Nutrient removal, Copper, Zinc, Cadmium, Nickel, Chromium, Municipal wastes, Waste water treatment.

The uptake of Cu, Zn, Cd, Ni, and Cr by rye, corn, stover, and sorghum-sudan plant tissue was evaluated in studies on the effects of the application of anaerobically-digested sewage sludge to croplands. Cu, Zn, Ni, and Cr were measured in the plant tissue and the DPTA-extractable fraction of the sludge-amended soil. Liquid sludge was applied to a sandy loam and a silt loam at rates up to 60 metric tons/ha on a dry solids basis. Although sludge additions had little effect on the heavy metal content of corn grain, elevated concentrations of Zn, Cd, and Ni were detected in plant tissue. Cr was not detected in either tissue or grain. The concentrations of the metals were under levels considered harmful to crops in all cases. The total recovery of the applied metals by all four crops was under 1% for Cu, Cd, Ni, and Cr; 1-3% of the applied Zn as recovered. The addition of metal-bearing sludge increased the DTPA-extractable fractions of Cu, Zn, Cd, and Ni, but not Cr. Regression analyses suggested that the quantity of heavy metal in the DTPA-extractable of soil may be a useful indicator of the heavy metal content of plant tissue from sludge-amended soils. (See also W78-04609 and W78-06059) (Snyder-FIRL)
W78-06060

RECENT ADVANCES IN SEWAGE EFFLUENT DENITRIFICATION: PART II,
Water Pollution Research Lab., Stevenage (England).
P. F. Cooper, B. Collinson, and M. K. Green.
Journal of the Institute of Water Pollution Control, Vol. 76, No. 4, p 389-401, 1977. 8 fig, 7 tab, 3 ref.

Descriptors: *Denitrification, *Aeration, *Anaerobic conditions, *Activated sludge, *Treatment facilities, Biodegradation, Organic substances, Waste water treatment, Municipal wastes, Sludge treatment, Sewage disposal.

Studies were conducted at a 9.1 million cu m/day sewage treatment plant in England to evaluate process modifications to remove all the nitrate present in recycled activated sludge. Anaerobic conditions were created by modification of two of the aeration units in the first part of a four-pass system. Two anaerobic areas were created in the third passes to the two other aeration units. Equal parts of recycled sludge and settled sludge were passed through the anaerobic zone. A 50% nitrate reduction was realized with the modifications in the first two units. Laboratory experiments were conducted to test units with two anaerobic areas under varying conditions of incremental sludge feed recycled sludge proportion. Tests indicated that nitrate removal increased to 69% when 40% of the settled sludge was retained in the second anaerobic zone for 30 minutes. Further studies showed that increasing retention time to 40 minutes resulted in a maximum 76% denitrification of the effluent. (See also W78-03541) (Lisk-FIRL)
W78-06061

A BLEACH SYSTEM FOR COLOR POSITIVE AND NEGATIVE FILM THAT REDUCES WASTE TREATMENT REQUIREMENTS,
Color Film Corp., Stamford, CT.
C. R. Dupree.
Society of Motion Picture and Television Engineers Journal, Vol. 87, No. 2, p 84-88, February, 1978. 7 fig, 2 tab, 7 ref.

Descriptors: *Bleaching wastes, *Photography, *Films, *Copper compounds, *Sodium chloride, Sodium compounds, Biochemical oxygen demand, Chemical oxygen demand, Chlorine, Waste water treatment, Industrial wastes, Halides, Chromium.

The efficiency and cost-effectiveness of substituting cupric chloride for dichromate bleach used in the photographic industry were assessed with respect to upgrading waste water effluent quality. A cupric chloride concentration of 21 g/liter provided the same bleaching capacity as the dichromate SR27 bleach. Comparative tests of the two bleaching agents indicated similar values for densitometry, physical effect on film, emulsion hardness, dye stability, drying characteristics, and washout properties. Cuprous chloride, formed by contact with silver, was regenerated to cupric chloride for reuse by dissolution in hydrochloric acid. A replenisher, controlled by a pH monitor,

maintained the levels of cupric chloride and hydrochloric acid in the processing chamber. The copper content of the waste water was reduced with the addition of an alkali metal hydroxide, sodium hypochlorite, forming an insoluble cupric hydroxide gel and an alkali metal chloride. The cupric hydroxide gel was filtered and regenerated with hydrochloric acid for reuse. The cost of producing 100 liters of cupric chloride, using scrap copper, proved to be at least $6 less than the cost of 100 liters of SR27 bleach. Other measures taken by Color Film Corporation of Stamford, Connecticut, to upgrade its waste for discharge into the municipal waste treatment facility included reduction of COD, BOD, and chlorine demand through careful control of replenishment rates, improved squeegees, and sodium hypochlorite treatment. (Lisk-FIRL)
W78-06066

WATER RECYCLING FLOW SCHEME FOR TOMATO PROCESSING PLANT CONTROLS SOIL ACCUMULATIONS,
G. E. Wilson, and J. Y. C. Huang.
Industrial Wastes, Vol. 24, No. 1, p 12-16, January-February, 1978. 1 fig, 7 tab, 5 ref.

Descriptors: *Food processing industry, *Tomatoes, *Flocculation, *Suspended load, *Coagulation, Colloids, Separation techniques, Suspended solids, Soil aggregates, Waste water treatment, Recirculated water, Industrial wastes, Recycling, Water reuse.

A process for the removal of accumulated soil in a tomato processing bin dump combines disc cleaning with water recycling and chemical coagulation of colloidal solids. Rubber discs with jet spray nozzles supply a vigorous washing action as the tomatoes pass through the unit. The soil-bearing wash water is collected in a tray and passed through a gravity screen for solids separation and then to a tube flocculator where chemical coagulation is accomplished. A comparison of this process with three other conventional methods revealed a possible 26% increase in the tonnage of tomatoes processed. Water consumption with this process was reduced to 164 gal/ton of tomatoes processed, compared to 278 gal/ton for conventional cleaning methods, 245 gal/ton for conventional cleaning with water recycle, and 156 gal/ton for disc cleaning with recycle but without flocculation. The quantity of soil removed with the disc unit and flocculation averaged 5,038 lb/day, compared to 3,827 lb/day with the disc cleaning without flocculation, and 1,628 lb/day with conventional methods with water recycle. The estimated cost of the disc cleaning system with recycle and flocculation was $0.933/ton of tomatoes, including capital expenses and electricity costs. The cost of the conventional method was calculated at $1.503/ton, while conventional washing with recycle and disc cleaning without flocculation were estimated to cost $1.216/ton and $0.918/ton, respectively. A potential net savings with the disc cleaning-flocculation system was estimated at $20,520/year. (Lisk-FIRL)
W78-06067

SPRAY DRYING TECHNIQUES FOR BY-PRODUCT RECOVERY,
Niro Atomizer, Soeborg (Denmark).
K. Masters, and I. Vestergaard.
Process Biochemistry, Vol. 13, No. 1, p 3-6, January, 1978. 7 fig, 2 tab.

Descriptors: *Food processing industry, *Drying, *Solid wastes, *Byproducts, *Separation techniques, Fermentation, Yeasts, Waste water treatment, Freeze drying, Industrial wastes.

Spray drying techniques are evaluated for the conversion of blood, fermentation products, protein wastes, glands, tissues, and other food processing wastes into usable dried solids. The spray drying processes described are either closed, semi-closed, or open and involve atomization, spray-air contact, evaporation, and separation of the dry product from the air. Byproducts having a low solids content, such as blood plasma, require pretreatment with a rotary thin-film concentrator prior to spray drying to decrease the heat requirements during the drying process. Fresh blood can be dessicated to 18% solids or to a powder with a moisture content of 5% by open cycle direct drying at inlet and outlet temperatures of 150C and 75C, respectively. 'Dirty' blood, used as adhesion agents or fodder stock, requires higher drying temperatures; blood for edible use can be separated-finto plasma and red albumin before spray drying. Plasma concentrations of 35-40% can be achieved with rotary film concentration prior to drying. Hormones and enzymes in glands and tissues are recovered by freezing to -30C for removal to the spray drying process. An 80% weight reduction is accomplished by open or semi-closed cycle drying with no loss of activity of the byproduct. Concentration of mycelium-fermentation broths prior to low temperature spray drying and incineration is required. An oxygen content of 5% is maintained during the semi-closed cycle spray dryer processing of the odorous broths. Residual odors and particle activity are destroyed by three second contact at 700-800C. (Lisk-FIRL)
W78-06068

PROTEIN RECOVERY FROM WASTE EFFLUENTS OF POTATO PROCESSING PLANTS,
Cornell Univ., Ithaca, NY. Dept. of Food Science.
D. Knorr.
Journal of Food Technology, Vol. 12, No. 6, p 563-580, December, 1977. 5 fig, 7 tab, 59 ref.

Descriptors: *Food processing industry, *Potatoes, *Proteins, *Separation techniques, Filtration, Amino acids, Organic compounds, Dewatering, Nitrogen, Waste water treatment, Industrial wastes, *Chemical precipitation.

Methods of recovery of potato protein from food processing wastes and the uses of the protein are reviewed. The volume of waste water from potato processing generally ranges 0.7-7.0 cu m/ton of potatoes. A series of processes which include protein precipitation, dewatering, drying, and sometimes concentration is generally used to treat the waste water. Heating of the protein water to 80-90C at pH 4.0-4.5 produced the most effective protein precipitation. Chemical treatment, especially with hydrogen chloride or polyphosphoric acid at pH 2.0, was also effective for protein removal. Settling of the protein precipitate was faster within the first 60 minutes for heat-treated samples than for samples at room temperature. Acidification to pH 5.0-2.0 and increased solids concentration also raised the protein settling rate. Methods for recovering protein and byproducts, such as amino acids, organic acids, and potassium phosphates, from the water after precipitation included: ion exchange, reverse osmosis, ultrafiltration, and hyperfiltration. Available separation techniques for precipitated protein include: continuous rotary filtration, plate and frame type filter pressing, gravity settling, or centrifugation. Plate frame filter pressing, followed by dewatering, drum or freeze drying, centrifugation, and spray drying, is recommended on the basis of comparative testing as the most efficient method of protein recovery from potato processing waste water. Uses suggested for the final protein product include additives in human food, substitutes in animal feed, and industrial applications. (Lisk-FIRL)
W78-06069

RECOVERY OF YEAST FROM CONFECTIONERY EFFLUENT,
Reading Univ., (England). Philip Lyle Memorial Research Lab.
A. J. Forage.
Process Biochemistry, Vol. 13, No. 1, p 8, 11, 30, January, 1978. 1 fig, 6 tab, 3 ref.

Descriptors: *Yeasts, *Food processing industry, *Carbohydrates, *Microorganisms, *Salts, Fermentation, Acration, Chemical oxygen demand, Biochemical oxygen demand, Waste water treatment, Industrial wastes.

A pilot plant study was conducted to examine the fermentation of carbohydrate-bearing confectionery effluent as a source of Candida utilis feed yeast. Because of effluent from confectionery production plants often contains more than 10,000 mg/liter BOD and 30,000-40,000 mg/liter COD, treatment measures must be taken to reduce BOD levels to standard levels of 20 mg/liter before discharge into a water course. The effluent, containing high concentrations of sucrose and glucose, was divided into streams of the high COD concentrations and the lower 1,000 mg/liter COD levels. Inorganic salts were introduced into the high COD-bearing effluent and the liquor was transferred to an aerated fermentation tank containing C. utilis under controlled pH and temperature conditions. Over a three-month period, COD removal averaged 74% with continuous fermentation and 11.18 g of yeast and filterable solids were produced per liter of effluent. The amino acid content of the yeast product was comparable to that of soybean meal. A cost comparison of COD removal by the yeast fermentation process and the trickling filter method was presented. (Lisk-FIRL)
W78-06070

ALUMINUM MANUFACTURER REMOVES CHROMIUM.
Industrial Wastes, Vol. 24, No. 1, p 24, 34, January-February, 1978.

Descriptors: *Chromium, *Heavy metals, *Separation techniques, *Aluminum, *Chemical precipitation, Sodium compounds, Colorimetry, Chemical analysis, Industrial wastes, Waste water treatment, Peat moss.

A treatment system for the removal of chrome and other chemicals produced by the manufacture of aluminum products has been developed by Hussong/Couplan. A series of three treatment tanks with a combined capacity of 6,000 gal/day effectively reduces the chromium content of the waste water by precipitation. The first tank serves as a receiving and holding tank for incoming waste which is pumped to the second stage once a predetermined level has been reached. Waste in the second tank is neutralized to pH 5.5-6.0 with the addition of sodium hydroxide. The addition of ferric chloride, followed by sodium sulfide, causes precipitation after a slow mixing of the solution. Full precipitation requires about four hours; the supernatant is then pumped to a third holding tank for eventual discharge. The precipitate is transferred to a sludge retention tank and then filtered through a plate and frame press. The resulting filter cake is stored in a 50-dal drum and the filtrate is turned to the initial holding tank. The Hussong/Couplan Chrome Removal System may be expanded by the addition of a sphagnum peat moss purification system to remove heavy metal pollutants. (Lisk-FIRL)
W78-06071

SODIUM BICARBONATE HELPS METAL PLANT MEET FEDERAL STANDARDS,
N. R. Barber.
Industrial Wastes, Vol. 24, No. 1, p 26, 29, January-February, 1978. 2 fig.

Descriptors: *Treatment facilities, *Toxins, *Metals, *Chemical precipitation, *Sodium compounds, *Hydrogen sulfide, Bicarbonates, Alkalis(Bases), Lime, Calcium carbonate, Carbonates, Waste water treatment, Industrial wastes.

Theoretical models were developed for the precipitation of toxic metals from metal processing effluent and other metal-bearing

wastes using sodium bicarbonate. Efficient toxic metal precipitation is achieved over a pH range of 8.0-9.0. Because sodium bicarbonate can only raise the pH of the effluent to 8.3, optimum pH levels can be established by the addition of a carbonate; total carbonate alkalinity can then be maintained for any pH level. The advantages of sodium bicarbonate precipitation in 200,000-500,000 gal/day industrial treatment plants were compared to those of other toxic metal precipitation processes. Lime precipitation, requiring precise additions and pH monitoring, yields large volumes of residual sludge due to incomplete dissolution and reaction with calcium and sulfates in the effluent. Both hydrogen sulfide and sodium sulfide treatment processes are activated by the pH of the effluent and bring about the precipitation metallic sulfide and hydroxide salts. Sulfide precipitation yields toxic residual sulfide ions. Sodium hydroxide can be easily handled and provides low sludge volume and precise pH control, although it is considered expensive. Calcium carbonate is better suited to batch processing systems as it dissolves slowly. (Lisk-FIRL)
W78-06073

PRESSURE DRIVEN MEMBRANE PROCESSES IN THE TREATMENT OF INDUSTRIAL EFFLUENTS,
Israel Desalination Engineering Ltd. Tel Baruch.
R. Matz, E. Zisner, and G. Herscovici.
Desalination, Vol 24, No 1/2/3, p 113-128, January, 1978. 5 fig, 10 tab, 7 ref.

Descriptors: *Membrane processes, *Membranes, *Reverse osmosis, *Separation techniques, *Oil industry, Food processing industry, *Filtration, Industrial wastes, Suspended solids, Waste water treatment, Pilot plants, *Ultrafiltration.

Reverse osmosis and ultrafiltration membrane processes were evaluated in pilot plant studies for the treatment of oil emulsion, citrus wash, and kerosene acid-wash wastes. Suspended solids removal from these industrial wastes was effectively accomplished by the ultrafiltration separation techniques; dissolved solids were removed by the reverse osmosis membrane process. Ultrafiltration of a 20% oil emulsion produced a nearly oil-free permeate, indicating that the flux decreased as the concentration of the waste increased. Ultrafiltration of citrus wash wastes produced a sugar removal of 90%, a clear effluent, and a pulp concentrate that had potential as a marketable byproduct. Ultrafiltration removed all suspended solids; reverse osmosis produced a product with 800 ppm COD. Reverse osmosis treatment of sulfuric acid-rinsed kerosene wastes produced an increase in total solids rejection of up to 98%, with decreasing flux and increasing contact time. Both membrane processes were found to perform effectively under increased temperatures, although feed conditions for each application had a proportional effect on the separation performance. (Lisk-FIRL)
W78-06075

COLOR REMOVAL FROM SOFTWOOD KRAFT PULP BLEACH PLANT EFFLUENT BY POLYAMINES,
Institute of Paper Chemistry, Appleton, WI.
T. C. Kisla, and R. D. McKelvey.
Environmental Science and Technology, Vol 12, No 2, p 207-211, February, 1978. 6 fig, 3 tab, 15 ref.

Descriptors: *Polyamines, Pulp and paper industry, *Pulp wastes, *Softwood, *Bleaching wastes, *Color, Chemical precipitation, Polymers, Analytical techniques, Conductivity, Zeta potential, Separation techniques, Waste water treatment, Industrial wastes.

Polyamine precipitation of color bodies was tested in laboratory experiments with freeze-dried, softwood kraft caustic effluent and the partially purified acid-precipitated color body fraction. Polyamines evaluated as precipitants were: PEI 18, 12, and 6, branched polymers of ethyleneamine; tetraethylene-pentamine; triethylenetetramine; diethylenetriamine; ethylenediamine; 1,3-diaminopropane; 1,4-diaminobutane; 1,12-diaminododecane; and ethylamine. The PEI 18 polymer removed 89-96% of the color from caustic extract effluent at pH 7.0 and 85-90% from the freeze dried caustic extract standard in an optimum pH range of 7.0-8.5 with PEI 18 concentrations of 550-800 ppm. Color removal from a caustic extract standard was achieved by the low molecular weight polyamines, although not as effectively as PEI 18. Only two diamines displayed any capacity for color removal. Precipitation of color bodies from a partially purified, acid-precipitated fraction by polyamines was dependent upon pH levels. Precipitation of color bodies from caustic extract standard by protonated polyamines indicated that color removal was more effective with triprotonated species. Polyamine concentration in the precipitates were proportional to the cationic polyamines in solution and the anionic characteristics of the color bodies. The conductivity and zeta potential of the precipitated particles were also measured. (Lisk-FIRL)
W78-06076

THE FLUOROMETRIC BEHAVIOR OF PULPING WASTE LIQUORS, A VALUABLE TOOL FOR LIGNIN AND PULPING RESEARCH,
Oregon State Univ., Corvallis. School of Forestry.
For primary bibliographic entry see Field 5A.
W78-06077

YEAST PRODUCTION ON SPENT SULPHITE LIQUOR,
Wilson Rowntree (Pty) Ltd., London (England).
L. A. McKee, and G. V. Quicke.
South African Journal of Science, Vol 73, No 12, p 379-381, December, 1977. 5 tab, 25 ref.

Descriptors: *Yeasts, *Sulfite liquors, Pulp and paper industry, *Pulp wastes, *Laboratory tests, Chemical oxygen demand, Biomass, Fermentation, Waste water treatment, Industrial wastes.

The production of Candida utilis food yeast from pulping mill spent sulfite liquor was tested in laboratory experiments. C. utilis was grown in diluted and undiluted steam-stripped spent sulfite liquor at concentrations of 26, 33, 44, and 52 ml/100 ml in media containing urea, potassium ihydrogen phosphate, and magnesium sulfate heptahydrate. The culture had an initial pH of 4.1-4.5 and was continuously agitated at 29C over periods from 41.3-72.3 hrs. Similar experiments were conducted with diluted steam-stripped spend sulfite liquor concentrations of 13, 26, and 39 ml/100 ml of medium with stationary phase times of 22.3, 38.7, 40.3, and 56.7 hrs. The lowest steam-stripped spent sulfite liquor concentrations produced efficient conversion of sugar to biomass. The most efficient growth of C. utilis, 15.21 kg of yeast/cu m of liquor/week, occurred in a medium cncentration of spent sulfite liquor after six hours. An annual yield of 8,507 tons of freeze dried yeast cells by batch culture or 9.358 tons by continuous culture was calculated from experimental data for the pulp mill liquor. The COD reduction in these experiments ranged 1.7-67.2%. Yeast growth on spent sulfite liquor was found economically viable only for yeast production at a rate of 100,000 tons/year. (Lisk-FIRL)
W78-06078

ELECTRON-BEAM OXIDATION TREATMENT OF A COMMERCIAL DYE BY USE OF A DUAL-TUBE BUBBLING COLUMN REACTOR,
Japan Atomic Energy Research Inst., Tasasaki. Tasasaki Radiation Chemistry Research Establishment.
W. Kawakami, S. Hoshimoto, K. Nishimura, T. Miyata, and N. Suzuki.
Environmental Science and Technology, Vol 12, No 2, p 189-194, February, 1978. 12 fig, 2 tab, 7 ref, 1 append.

Descriptors: *Irradiation, *Oxidation, *Dyes, *Dissolved oxygen, *Nitrogen, Aeration, Degradation(Decomposition), Radiation, Waste water treatment, Industrial wastes.

Electron-beam oxidation using a dual-tube bubbling column reactor was evaluated for the treatment of Acid Red 265 dye in laboratory experiments. Aqueous solutions of commercial azo dye at concentrations of 50-400 ppm were fed into the five-stage, dual-tube bubbling column after one hour of oxidation and agitation in a solution tank. Oxygen was bubbled through the solution in each column at a rate of 0.5-3.0 liters/minute at ambient temperatures. The solution was subjected to a 20-minute irradiation period with beam currents of 1.0-3.0 mA and tested for pH, dissolved oxygen, and absorption spectra. Electron-beam oxidation of the dye solution resulted in a color reduction of 95% after 0.2 Mrad irradiation of a 100 ppm aqueous dye solution. Conversion of the solution was greater at higher flow rates; dissolved oxygen concentrations increased gradually in later stages after a sharp initial decrease. Similar tests conducted with nitrogen as the bubbling agent produced less decoloration of the aqueous solution. (Lisk-FIRL)
W78-06079

NATURE AND TREATABILITY OF DYEING WASTEWATERS,
Hawaii Univ. at Manoa. Dept. of Agricultural Engineering.
P. Y. Yang, and M. B. Pescod.
American Dyestuff Reporter, Vol. 66, No. 12, p 47-52, 54, 71, December, 1977. 13 fig, 7 tab, 1 ref.

Descriptors: *Textiles, *Dyes, *Polymers, *Lime, *Chemical degradation, Activated sludge, Dewatering, Chemical oxygen demand, Biochemical oxygen demand, Sampling, Waste water treatment, Industrial wastes.

Polymerization and dyeing waste waters produced by the Asia Fiber Co., Ltd., in Thailand were biologically and chemically treated. Flow rates of the waste water in the dyeing and the polymerization plants were monitored over a 25-day period; waste water samples were taken over a nine-day period. Flow-proportioned composite samples were analyzed for COD, BOD, nitrogen, phosphorus, solids, pH, and temperature. The temperature and pH of the polymer samples averaged 42.2C and pH 8.35; the dyeing waste water averaged 39.3C with a pH 7.66. Chemical treatment of polymerization waste water with alum and lime proved ineffective in reducing COD levels, removing less than 15% of the COD at high chemical doses. Treatment of the dyeing waste with alum and lime not only achieved significant removal of COD levels, but also substantially reduced the color content and improved the sludge dewatering properties. Biological treatment of the dyeing waste after alum treatment produced a reduction of 73.2% in COD content. A COD removal of 82.7% was achieved by mixing the polumerization waste with the alum-treated dyeing waste supernatant. The use of extended aeration and aeration basin processes yielded a COD removal of more than 92%. (Lisk-FIRL)
W78-06080

DYEBATH REUSE IN BATCH DYEING,
George Inst. of Tech. Atlanta. School of Textile Engineering.
F. L. Cook, and W. C. Tincher.
Textile Chemist and Colorist, Vol. 10, No. 1, p 21-25, January, 1978. 10 tab, 7 ref.

Descriptors: *Dyes, *Dye dispersion, *Color, *Water analysis, *Recirculated water, Plastics, Industrial wastes, Textiles, Waste water treatment, On-site data collections, Water reuse.

Dyebath reuse was evaluated for batch dyeing of nylon carpet, nylon panty-hose, and polyester yarn. After an initial, standard dyeing of a batch of nylon carpet, water removed during the dyeing process was replaced and dyes were replenished. Carpet was then dyed using the recycled bath; end-to-end color differences of the carpet ranged 0.40-5.16 MacAdam units. The estimated savings in water and energy were 65% and 15%, respectively. Similar tests on the dyeing of pantyhose yielded a color difference ranging 2.53-6.35 MacAdam units from a control. Pantyhose samples dyed by conventional methods and considered 'just passable as first quality' exhibited a color difference of 7.78 MacAdams units for the medium limit and 2.89 MacAdam units for the dark limit. Savings of 90% in water and 35% in energy were realized in the dyebath reuse process. After polyester yarn was dyed in seven different color series, lot-to-lot and through-package color differences were analyzed. Single shade pressure dyeing with dyebath reuse resulted in acceptable coloration, as did multicolor dyeing when dyes were overlapped. Dyebath reuse for polyester yarn resulted in an 81% water and 41% energy savings. Carpet and pantyhose dyed with the reused dyebaths were considered acceptable as first-quality merchandise. (Lisk-FIRL)
W78-06081

MEMBRANE PROCESSES USED FOR THE TREATMENT OF INDUSTRIAL EFFLUENTS,
Istituto di Ricerca sulle Acque, Rome (Italy).
P. Mappelli, M. Santori, A. Chiolle, and G. Gianotti.
Desalination, Vol. 24, No. 1/2/3, p 155-173, January, 1978. 4 fig, 12 tab, 14 ref.

Descriptors: *Textiles, *Membrane processes, *Reverse osmosis, *Membranes, *Separation techniques, Pilot plants, Fibers(Plant), Oxidation, Activated carbon, Ion exchange, Waste water treatment, Industrial wastes.

Pilot plant studies were conducted on the treatment of synthetic and acrylic fiber production waste water by ultrafiltration and reverse osmosis membrane processes. A mobile unit equipped with three ultrafiltration modules and three reverse osmosis membrane processes was used to test the recovery rates of the membranes in the treatment of nondegradable effluents from a fiber finishing plant and an acrylic fiber plant. Laboratory tests were also conducted to determine suitable operating pressures and rejection factors for treatment of the two types of effluent. The effluent from the fiber finishing plant, which contained a high concentration of non-ionic surfactants of low biodegradability, was acidified to pH 5.1 with sulfuric acid before treatment. Recovery rates, ranging from 88.5-98.6%, as well as flow rate, pH, COD, total organic carbon, and non-ionic surfactants concentrations were measured after filtration through a DDs 995 cellulose acetate membrane. The adsorption capacity of activated carbon for the fiber finishing effluent was also tested. The treatment of effluent from the production of acrylic fibers, containing high concentrations of sulfites and other organic substances, with activated carbon, ion-exchange resins, distillation, or chemical or biological treatment was not economically feasible. Three different oxidizing agents were tested before reverse osmosis was conducted at a recovery factor of 80-90%. Recovery rates of 78.0-97.3% were obtained with a feed pressure of 42 kg/sq cm at 20C. Operating and capital costs were calculated for treatment of 200 cu m/hr of acrylic fiber effluent. (Lisk-FIRL)
W78-06082

OPTIMIZATION OF DESIGN AND OPERATIONS OF ACTIVATED SLUDGE WASTEWATER TREATMENT SYSTEMS,
State Univ. of New York at Buffalo.
E. W. Craig.
Available from University Microfilms International, Ann Arbor, Michigan 48106; Order No. 77-32-646. PhD Thesis, 1977, 220 p.

Descriptors: *Activated sludge, *Optimization, *Analytical techniques, *Computer programs, *Flow rates, Treatment plants, Phosphorus, Mathematical models, Forecasting, Data collections, Waste water treatment, Municipal wastes.

A Box-Complex algorithm was employed to optimize the design and operation of an activated sludge waste water treatment process with a sludge reuse capability. The use of a nonlinear objective function and nonlinear, noncontinuous constraints with the Box technique permitted realistic models for unit processes. Predicted flow rates and a discrete time series definition were used in a plant performance technique developed for higher effluent quality at the lowest cost. A procedure for the optimization of an existing activated sludge plant with phosphorus reduction was designed to incorporate flow prediction data. A digital computer program was devised for plant optimization using the Box Search technique. Solids retention time and the recycle ratio were used as the control variables. According to the results of the computer program, substantial savings could be realized wih flow rate predictions and other data. (Lisk-FIRL)
W78-06094

AEROBIC DIGESTION OF SEWAGE LIME SLUDGE,
Missouri Univ.-Rolla.
K-C. Tsai.
Available from University Microfilms International, Ann Arbor, Michigan 48106; Order No. 77-23,686. PhD Thesis, 1977, 263 p.

Descriptors: *Sludge digestion, *Aerobic treatment, *Phosphorus, *Sludge treatment, *Lime, Dewatering, Biological treatment, Hydrogen ion concentration, Design criteria, Operation and maintenance, Chemical oxygen demand, Dissolved oxygen, Sewage treatment, Waste water treatment.

Laboratory studies were conducted to establish design and operational criteria for aerobic digestion of lime sewage sludge generated during phosphorus precipitation in a primary clarifier. Batch and semi-continuous flow reactors were operated at temperatures, of 10, 20, and 30C. Parameters used in the evaluation of optimal process design and control included: detention time, oxygen uptake rate, volatile suspended solids destruction, liquid sludge COD reduction, supernatant COD and phosphorus contents, sludge settleability and dewaterability, and potential phosphorus release. The studies indicated that lime sludges having an initial pH as high as 11.0 are aerobically digestible in the presence of appropriate microorganisms. An optimal sludge retention time of 10 days and an air flow of 60 scfm/1000 cu ft of digester volume were suggested for a semi-continuous flow unit operating at 20C. A dissolved oxygen concentration of 1-2 mg/liter and a pH above 7.0 are recommended to minimize potential phosphorus release from the sludge to the liquid phase. The sludge was easily settled and dewaterability was improved significantly by digestion. (Schulz-FIRL)
W78-06095

TEMPERATURE EFFECTS ON THE ACTIVATED SLUDGE PROCESS,
Texas Univ. at Austin.
B. A. Sayigh.
Available from University Microfilms International, Ann Arbor, Michigan 48106; Order No. 77-23,030. PhD Thesis, 1977, 196 p.

Descriptors: *Activated sludge, *Mathematical models, *Temperature, *Suspended solids, *Microorganisms, Biological treatment, Oxygen requirements, Aerobic treatment, Sludge treatment, Municipal wastes, Industrial wastes, Waste water treatment.

Since the completely-mixed, continuous-flow activated sludge process is currently one of the most commonly used aerobic modes of biological waste water treatment, studies were conducted to study the effects of temperature variations on the kinetics and performance of the process. Domestic waste water, an organic chemicals industrial waste water, and the mixed waste water from several industries were used in laboratory experiments at 4, 10, 15, 20, and 30C. The control parameter used in the laboratory-scale experiments was sludge age. Filtered COD, filtered TOC, and/or filtered BOD were used as measures to influent and effluent substrate concentrations. Mixed liquor volatile suspended solids (MLVSS) levels were used as an indication of microorganism concentration. The experiments examined the effect of temperature on kinetic coefficients governing cell synthesis, microorganism decay, soluble substrate utilization, and dissolved oxygen utilization. A mathematical model was presented for the interrelationship between steady state MLVSS concentrations, the net rate of MLVSS production, and sludge age. (Schulz-FIRL)
W78-06115

THE TREATABILITY OF LEACHATES FROM SANITARY LANDFILLS,
Drexel Univ., Philadelphia, PA. Coll. of Business Administration.
R. J. Buchanan, Jr.
Available from University Microfilm International, Ann Arbor, Michigan 48106; Order No. 77-22,526. PhD Thesis, 1977, 253 p.

Descriptors: *Leachate, *Landfills, *Thiobacillus ferrooxidans, *Sulfur bacteria, *Mine acids, Chemical precipitation, Coagulation, Activated sludge, Biological treatment, Activated carbon, Hydrogen ion concentration, Waste water treatment.

Physicochemical and biological treatment processes applicable to leachates from sanitary landfills were investigated in bench-scale and full-scale experiments. Laboratory experiments examined the effects of precipitants, coagulants, activated carbon, low pH biological treatment, and conventional activated sludge processes on landfill leachates. Treatment with the ferrous oxidizing bacterium, Thiobacillus ferrooxidans, in the low pH treatment scheme was demonstrated as feasible for leachates. (Schulz-FIRL)
W78-06148

SUMMARY OF DRAFT 201 FACILITY PLAN FOR UPGRADING METRO PUGET SOUND PLANTS,
Metropolitan Engineers, Seattle, WA.
For primary bibliographic entry see Field 5G.
W78-06149

5E. Ultimate Disposal Of Wastes

AN EVALUATION OF ALTERNATIVE SLUDGE TECHNOLOGIES: A SURROGATE WORTH TRADEOFF APPROACH,
New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.
B. E. Lindsay.
Water Resources Bulletin, Vol 14, No 1, p 55-62, February 1978. 1 fig, 1 tab, 4 ref.

Descriptors: *Sewage sludge, *Disposal systems, *Multiobjective programming, *Surrogate worth tradeoff method, Methodology, Least squares, Decision making, Evaluation, Environmental impact, Benefit maximization, Economic efficiency, Optimization, Constraints, Equations, Mathematical models, Systems analysis, *Boston(Mass), Massachusetts.

Problems with current modes of sewage disposal have caused researchers to seek new methods. The selection among alternative disposal methods must be made with explicit recognition of the tradeoffs involved. This paper develops a multiple objective decision making framework based upon alternative disposal systems, incorporating two objectives: economic benefit maximization and optimal level of environmental impact. Utilized is the surrogate worth tradeoff method, which directly involves decision makers in determining optimum levels in objective space. Evaluated are alternative sewage disposal systems for the Boston Massachusetts area. (Bell-Cornell)
W78-05707

A MODEL FOR PLANNING AND LOCATION OF ON-SITE WASTE DISPOSAL SYSTEMS,
Wisconsin Univ., Madison. Coll. of Agricultural and Life Sciences.
F. G. Baker.
Water Resources Bulletin, Vol 14, No 1, p 144-156, February 1978. 3 fig, 2 tab, 18 ref.

Descriptors: *Waste disposal, *Waste water(Pollution), *Management, *Planning, *System performance, *Probability, *Regional analysis, Home waste disposal, Soil characteristics, Behavior, Land use, Evaluation, Waste water treatment, Decision making, Forecasting, Equations, Operations research, Mathematical models.

A probabilistic model that incorporates performance data about several wastewater management systems is discussed. From these data, the expected behavior of an individual wastewater system or group of systems can be predicted within limits. To illustrate how the selection of a management system for a particular site is based on the site's limiting factors, an example problem is considered: a humid location in central Wisconsin where bedrock is greater than six feet below the surface but groundwater is only two feet below the soil surface for most of the year. Also, the behavior of a wastewater system can be treated as the product of the performance probabilities of its individual components. The model can be used on a regional scale facilitating land use planning by allowing accurate estimates of performance for a prospective wastewater management system. At this scale, it can allow the impact evaluation of new wastewater technology on land use in a region. (Bell-Cornell)
W78-05713

THE ENVIRONMENTAL COSTS OF LANDFILLS AND INCINERATORS,
Chicago Univ., IL. Center for Urban Studies.
O. Hockman, E. Hwang, and G. Rudzitis.
Available from the National Technical Information Service, Springfield, VA 22161 as ANL 76-XX-15, Price codes: A02 in paper copy, A01 in microfiche. Energy Research and Development Administration, ANL-76-XX-15, July 1976. 10 p, 1 fig, 1 tab, NSF-RANN AG-352 and GI 32989A2.

Descriptors: *Landfills, *Incinerators, *Costs, Municipal wastes, *Waste disposal, *Environmental effects, *Cities, Solid wastes, Chicago, Illinois, Alternative costs, Economics, Model studies, Cost analysis, Cost-benefit analysis.

A study of economic and environmental costs of sanitary landfills and incineration for nonhazardous municipal solid wastes in the Chicago metropolitan area concludes that total social costs of landfills are only 25% as large as incineration costs. Landfill costs are lower both for (1) investment and operating costs alone, and (2) total social costs, including environmental costs. The total cost for incineration was calculated at $16.35/ton of refuse, compared with $4.32/ton for landfills. While the data pertain to the Chicago area, these conclusions may apply to other large cities. At a properly operated sanitary landfill, solid waste is compacted and covered by at least six inches of earth; refuse is not burned. Neither groundwater nor surface water pollution should result. Capital costs are low, and no sorting of waste is needed. Upon completion, the land usually can be reclaimed for golf courses, playgrounds, or parking lots. Drawbacks include the need for large land tracts, political jurisdiction problems, and transportation costs increasing with distance from the landfill. Incineration (including residue disposal) requires much less land and can be located nearer the area served, but capital and operating costs are considerably higher. Skilled personnel and dust and ash control devices are required. For environmental and economic cost comparisons in this study, 55 landfill sites and eight incinerators were analyzed. Air dispersion and damage models were employed. (Lynch-Wisconsin)
W78-05738

COMBATING RIVER POLLUTION.
For primary bibliographic entry see Field 5G.
W78-05744

BIOLOGICAL TREATMENT OF SPENT VEGETABLE TANNINS WITH FUNGAL DOMINANT SYSTEM,
West Virginia Univ., Morgantown.
For primary bibliographic entry see Field 5D.
W78-05807

DESIGN OF AN OUTFALL,
Montgomery (James M.), Inc., Pasadena, CA.
For primary bibliographic entry see Field 8B.
W78-05828

USE OF MIXING PIPES TO IMPROVE THE FLOW OF WASTE WATER INTO LAKES (EINSATZ VON MISCHROHREN ZUR VERBESSERUNG DER EINLEITUNG VON ABWASSER IN SEEN),
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
K. Hofer, K. Hutter, and D. Vischer.
Gas-Wasser-Abwasser, Vol. 57, No. 12, p 846-852, 1977. 9 fig, 1 tab, 11 ref.

Descriptors: *Outfall sewers, *Waste water disposal, Lakes, *Design criteria, *Sewage disposal, *Waste dilution, Sewers, Phosphorus, Nutrient removal, Surface waters, Waste assimilative capacity, Waste water treatment.

Methods of reducing the height of rise and increasing the overall dilution of purified waste water discharged into lakes are evaluated. The reduction in the height of rise is considered necessary to prevent the acceleration of biosynthetic processes by the high levels of phosphorus in the waste water. Diffusers based on the water jet pump principle are considered suitable, depending on the degeee of stratification of the lake water. For a nonstratified lake, diffusers having a diffuser diameter to nozzle diameter ratio greater than 1.86 are required to improve the degree of mixing. Advantages afforded by premixing are greater with lower Froude numbers and stratificaion parameters and with an increase in the diffuser to nozzle diameter ratior. Modifications in the nozzle design can be used to economically and efficiently adjust the discharge cross-section and the Froude number with respect to variations in the waste water discharge. (Takacs-FIRL)
W78-05829

WASTE WATER FLAME DECONTAMINATION--BY DIVIDING HIGH TEMPERATURE COMBUSTION PRODUCTS INTO NUMBER OF STREAMS CORRESPONDING TO NUMBER OF CONTROL STAGES.
Soviet Patent SU-548-749. Issued March 30, 1977.
Derwent Soviet Inventions Illustrated, Vol A, No. 1, p 3, February, 1978. 1 fig.

Descriptors: *Organic matter, *Incineration, *Gases, *Water vapor, *Patents, Oxidation, Control systems, Design data, Equipment, Waste water treatment, Municipal wastes.

A combustion system for the decontamination of organic and mineral-bearing waste water using steam, gas, and high-temperature combustion products of the treatment process has been patented. After incineration in a furnace, high temperature combustion products are separated into a number of streams equal to the number of control treatment stages. These high temperature streams are used in combustion chambers to oxidize steam and gas mixtures produced in the previous control stage. Thus, one stream of high temperature combustion material is combined with waste water in one control stage to produce a steam/gas mixture. This steam/gas mixture flows into a combustion chamber where it is oxidized by another stream of high temperature combustion products. The hot gases produced in this stage are passed onto the second stage which repeats the process. The process is repeated a total of three times, producing a final effluent containing non-volatile organic material and mineral impurities. This effluent is returned to the initial furnace for incineration and repetition of the entire process cycle. (Lisk-FIRL)
W78-05842

WASTEWATER PLANT HAS AN EYE ON THE FUTURE,
Raleigh Pollution Control Office, NC.
For primary bibliographic entry see Field 5D.
W78-05843

CHLORINE AND ACID CONDITIONING OF SLUDGE,
California State Water Resources Control Board, Sacramento.
For primary bibliographic entry see Field 5D.
W78-05847

DISSOLVED METALS IN AQUEOUS EFFLUENTS FROM MUNICIPAL INCINERATORS,
Bureau of Mines, College Park, MD. Coll. Park Metallurgy Research Center.
S. L. Law.
Journal Water Pollution Control Federation, Vol 49, No 12, p 2453-2466, December, 1977. 5 fig, 9 tab, 20 ref.

Descriptors: *Metals, *Dissolved solids, *Incineration, *Fly ash, *Potable water, Municipal wastes, Waste water treatment, Treatment facilities, Cadmium, Manganese, Zinc, Lead, Maryland, Virgina, District of Columbia.

The environmental impact of dissolved metal concentrations in the water systems of three municipal incineration operations was examined. Flyash scrubber water and quench water, utilized in separate processes by Alexandria, Virginia's municipal incinerator, were used as the basis for the study. The combined flyash and quench waters from incinerators in Washington, Distict of Columbia, and from Montgomery County, Maryland, were also analyzed for dissolved metal contents. Concentrations of 26 elements were measured in water samples taken from the plants during operation and just before discharge of waste water into municipal waste treatment facilities. Levels of dissolved metals in waste water from the three operations were found to be low enough so that biological treatment of wastes in the municipal plants would not be significantly hindered. Zinc concentrations in the Alexandria incineration wastes were considered to be detrimental to

biological treatment if discharge were made directly into the waste treatment facility. Comparison of metal concentrations with Environmental Protection Agency drinking water standards revealed consistent excessive concentrations of cadmium, manganese, lead, selenium, and zinc in Alexandria's recycled flyash waters. Further treatment of the water from the three incineration operations would be required before discharge into surface water or public water supplies. (Lisk-FIRL)
W78-05848

FROM WASTEWATER TO RESOURCE IN ST. PETERSBURG, FLORIDA,
For primary bibliographic entry see Field 5D.
W78-05851

NO METAL UPTAKE BY CORN OR GRASS.
Agricultural Research, Vol. 26, No. 7, p 10-11, January, 1978.

Descriptors: *Heavy metals, *Fertilization, *Corn(Field), *Grasses, *Agricultural watersheds, Demonstration watersheds, Chromium, Zinc, Copper, Lead, Nickel, Cadmium, Sewage sludge, Waste water treatment, Minnesota.

A study of sewage sludge application to corn and reed canarygrass crops was conducted over a 2-3 year period. A two-year application at a rate of 4 tons/acre/yr of digested sewage sludge was used to fertilize a reed canarygrass crop planted on a 40-acre terraced watershed in Minnesota. A higher annual production yield was obtained with sewage, 4.4 tons/acre canarygrass, than with conventional fertilizer, 3.5 tons/acre. Similar results were found with applications of 4.5 tons/acre-yr to corn and grass crops over a three-year period. Annual yields per acre averaged 108 bushels of corn and 6.5 tons of fodder with sludge as the fertilizer, compared to 102 bushels of corn and 6.1 tons of fodder with conventional fertilizer. The sewage sludge applied to the crops contained chromium, zinc, copper, lead, nickel, and cadmium. The heavy metal content in the sludge-treated corn grain and leaf tissue and in the reed canarygrass was not different from the content in the other crops. Surface and soil waters in the research watershed did not display higher concentrations of these heavy metals nor was there significant movement of pollutants through the groundwater. During snowmelt, spring runoff, and high rainfall, some movement of plant nutrients was detected in surface waters on the sludge-fertilized areas. (Lisk-FIRL)
W78-05853

EFFECTS OF INCUBATION AND LIMING ON YIELD AND HEAVY METAL UPTAKE BY RYE FROM SEWAGE-SLUDGED SOIL,
Agricultural Research Service, Beltsville, MD.
J. V. Lagerwerff, G. T. Biersdorf, R. P. Milberg, and D. L. Brower.
Journal of Environmental Quality, Vol. 6, No. 4, p 427-431, October-December, 1977. 3 fig, 4 tab, 12 ref.

Descriptors: *Sludge disposal, *Fertilization, *Heavy metals, *Vegetation effects, *Pollutant identification, Incubation, Lime, Zinc, Cadmium, Lead, Copper, Analytical techniques, Municipal wastes.

Rye (Secale cereale) was greenhouse-grown in sandy loam fertilized with digested secondary sludge in studies to evaluate the yield and uptake of Cd, Cu, Pb, and Zn as a function of sludge origin, pH, incubation time between mixing and planting, and plant age. Sludge appliction rates of 0-10% on a dry weight basis and incubation times ranging 0-7 weeks were used. The effects of sludge obtained from Baltimore, Maryland, and Washington, District of Columbia, were compared. Comparisons of three successive clippings revealed that plant yields decreased at higher sludge application rates. Metal uptake increased with sludge addition and with plant age, with the effect being greatest for Zn, followed by Pb and Cu. With the addition of lime, the uptake of Zn from sludge decreased, followed by Cd, Pb, and Cu. The uptake of Cu and Pb significantly decreased with incubation. The data suggested that the tendency to form organic complexes was greater for Cy than for Pb, Zn, and Cd. The relative uptake of HCL-extractable Cd from the soil was greater than that of Zn, especially upon liming. (Snyder-FIRL)
W78-05863

THE USE OF FAECAL BACTERIA AS A TRACER FOR SEWAGE SLUDGE DISPOSAL IN THE SEA,
Ministry of Agriculture, Fisheries and Food, Burnham-on-Crouch (England). Fisheries Lab.
For primary bibliographic entry see Field 5B.
W78-05876

A FAECAL STEROL SURVEY IN THE CLYDE ESTUARY,
Bristol Univ. (England). Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W78-05879

DISTRIBUTION OF VIRAL AND BACTERIAL PATHOGENS IN A COASTAL CANAL COMMUNITY,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
For primary bibliographic entry see Field 5B.
W78-05880

NEARSHORE SEDIMENT POLLUTION IN ISRAEL BY TRACE METALS DERIVED FROM SEWAGE EFFLUENT,
Hebrew Univ. of Jerusalem, Rehovot (Israel). Dept. of Soil and Water Science.
For primary bibliographic entry see Field 5B.
W78-05887

CONVERTING WASTES TO ENERGY--A CONCEPTUAL APPROACH,
Nihoa Suido Consultants Co. Ltd., Tokyo.
For primary bibliographic entry see Field 5D.
W78-05896

UNDERGROUND INJECTION OF LIQUID WASTE CAN BE ENVIRONMENTALLY SOUND,
Texas Water Quality Board, Austin.
J. W. Mullican.
Water and Sewage Works, Vol. 124, No 12, p 62-63, December, 1977.

Descriptors: *Waste disposal wells, *Underground waste disposal, *Injection, *Geologic control, *Environmental engineering, Liquid wastes, Texas, Administrative agencies, Analytical techniques, Legislation, Waste water disposal.

Subsurface injection can be an environmentally sound method of waste disposal. In Texas, the Disposal Well Act requires certification by the Texas Water Quality Board that wastes will not be injected into freshwater strata, protecting groundwater resources. Subsurface disposal of other wastes requires a thorough engineering and geological evaluation of the waste character, well design, construction, operation, and monitoring program. Injection is only permitted after other methods have been found less desirable with regard to environmental protection and dependability. A technical staff qualified to evaluate applications in light of current developments is required. Application for a permit requires an on-site inspection and a technical report including information on local topography and geology, chemical and physical characteristics of the waste, and average and maximum anticipated injection rates. Disposal wells are inspected routinely; routine measurements of surface injection pressures and water analyses are required. Safe abandonment of the injection well and the effect on improperly plugged wells in the vicinity must also be considered. Proper plugging confines the injected wastes to a specific area. Cement plugs must be properly placed at the top of the injection zone, across any formation producing oil or gas, and at the top and bottom of the surface casing. (Snyder-FIRL)
W78-05899

BEHAVIOR OF ANIONIC SURFACTANTS IN A SOIL-SEWAGE EFFLUENT SYSTEM,
Agricultural Research Organization, Bet Dagan (Israel). Inst. of Soils and Water.
For primary bibliographic entry see Field 5B.
W78-05900

IMPROVING SUBSURFACE DISPOSAL SYSTEM PERFORMANCE,
Agricultural Research Center, Beltsville, MD.
E. E. Jones, Jr.
Journal of Environmental Health, Vol. 40, No. 4, p 186-190, 1978.

Descriptors: *Subsurface drainage, *Septic tanks, *Domestic wastes, *Soil disposal fields, *Soil dynamics, Percolation, Soil classification, Hydraulic structures, Drainage engineering, Waste water treatment, Waste water disposal.

Factors influencing the longevity of domestic subsurface disposal systems, including oxidation potential, soil percolation, hydraulic loading, soil type, and weather, are discussed. Consideration of primary and secondary soil moisture is necessary in the construction of disposal systems. Increasing the soil moisture content reduces the oxidation potential of the soil to below the level required for the degradation of organic compounds. Excessive soil moisture content can lead to anaerobic conditions and early failure of the septic system. Time controlled, intermittent loading systems with manual override and overload alarm are recommended for hydraulic loading of sand over alternated systems, volume controlled intermittent systems, and direct gravity loading systems. The time-volume control system limits loading to 0.5 cm/hr with 4-10 doses daily. Intermittent uniform pressure distribution and alternated loading systems are recommended for silt and clay loam soils with percolation rates ranging 60-300 minutes/inch. Sandy loam soils have percolation rates ranging 1-12.9 minutes/inch. Soil disposal systems located in soils with percolation rates of 0-5 minutes/inch have an estimated life of 13-36 years for families of 1-6 members. Disposal system longevity is also calculated for fair and poorly percolated soils. (Lisk-FIRL)
W78-05901

PURIFICATION OF SECONDARY EFFLUENT IN A NATURAL SAND FILTER,
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5D.
W78-05902

NITRATE LEACHING DURING LONG-TERM SPRAY IRRIGATION FOR TREATMENT OF SECONDARY SEWAGE EFFLUENT ON WOODLAND SITES,
Pennsylvania State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W78-05903

THE IMPACT OF WATER SAVING WATER CLOSETS ON BUILDING DRAINS AND SEWERS,
Pennsylvania State Univ., University Park. Inst. for Research on Land and Water Resources.
For primary bibliographic entry see Field 3D.
W78-05904

DISCHARGE OF NITROGEN, PHOSPHORUS AND ORGANIC MATTER INTO THE GULF OF BOTHNIA,
National Swedish Environment Protection Board, Uppsala. Limnological Survey.
For primary bibliographic entry see Field 5B.
W78-05905

COST-EFFECTIVENESS OF ON-SITE AND COMMUNITY SEWERAGE ALTERNATIVES,
Brown and Caldwell, Eugene, OR.
For primary bibliographic entry see Field 5D.
W78-05910

CHARACTERISTICS OF MUNICIPAL WASTEWATER DISCHARGES, 1976,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5B.
W78-05912

METALS IN POWER PLANT COOLING WATER DISCHARGES,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5B.
W78-05913

IN SITU MEASUREMENTS OF INITIAL DILUTION,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5B.
W78-05915

COASTAL CURRENTS,
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5B.
W78-05916

PHOSPHORUS DYNAMICS IN SOILS IRRIGATED WITH MUNICIPAL WASTEWATER,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 5D.
W78-05937

THE BACTERIAL POLLUTION OF THE COASTAL WATERS OF THE PROVINCE OF ROME, (IN ITALIAN),
Ufficio Medico Provincial di Rome (Italy).
For primary bibliographic entry see Field 5C.
W78-05948

INFECTIOUS HOSPITAL WASTES: THEIR TREATMENT AND SANITARY DISPOSAL,
Florida Univ., Gainesville. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 5D.
W78-05949

USE OF A NATURAL MARSH FOR WASTEWATER POLISHING,
Wisconsin Univ.-Oshkosh.
For primary bibliographic entry see Field 5D.
W78-05960

EUTROPHICATION AND WATER POLLUTION,
Federal Water Pollution Control Administration, Washington, DC.
For primary bibliographic entry see Field 5C.
W78-05982

EFFECT OF LAND DISPOSAL APPLICATIONS OF MUNICIPAL WASTES ON CROP YIELDS AND HEAVY METAL UPTAKE,
National Fertilizer Development Center, Muscle Shoals, AL.
For primary bibliographic entry see Field 5B.
W78-05985

HANDLING AND DISPOSAL OF SLUDGES FROM COMBINED SEWER OVERFLOW TREATMENT, PHASE I - CHARACTERIZATION,
Envirex, Inc., Milwaukee, WI. Environmental Sciences Div.
M. K. Gupta, E. Bollinger, S. Vanderah, C. Hansen, and M. Clark.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 212, Price codes: A10 in paper copy, A01 in microfiche. Report No. EPA - 600/2-77-053a, May, 1977. 188 p, 44 fig, 51 tab, 55 ref, 3 append. 68-03-0242.

Descriptors: *Combined sewers, *Overflow, *Pesticide residues, *Sludge disposal, *Sewage treatment, *Pesticides, *Heavy metals, Pollutant identification, Sludge, Solid wastes, Ultimate disposal, Solid wastes, Volumetric analysis, Volumes, Suspended solids, Sludge characterization, Combined sewer overflow, Sludge treatment(Physical physical/chemical biological), Pump/bleedback, *Dry-weather sludge, Residual quantity, Residues, Sludge, Drying, Characterization.

The results of a charcterization and treatment test program to develop optimum means of handling and disposing of residual sludges from combined sewer overflow (CSO) treatment systems are summarized. Desk top engineering reviews were conducted to gather, analyze, and evaluate pertinent information relating to pump/bleedback of treatment residuals to the dry-weather sludge handling/treatment and disposal facilities. The volumes and characteristics of the residual vary widely; volumes ranged from less than 1% to 6% of the raw volume treated and contained 0.12% to 11% suspended solids. Sludge volatile contents varied between 25% and 63% with biological treatment residuals showing the highest volatile content and fuel values. The heavy metal and pesticide concentrations of the various sludges were observed to be significant and are presented. Pump/bleedback of CSO treatment may be impractical for an entire city because of the possibility of hydraulic and/or solids overloading of the dry-weather treatment facilities. Controlled pump/bleedback of a selective basis may be feasible. For low solids content residuals (storage, screen backwash, waste activated sludge, etc.), gravity or flotation thickening are the optimum steps for the removal of the major water portion, while centrifugation and vacuum filtration are the optimum dewatering techniques for the high solids content residuals (settled storage treatment sludge, flotation scum, and other thickened sludges) prior to their disposal by incineration of landfill. Follow-up study recommendations are outlined. (Seip - IPA)
W78-05987

USE OF CLIMATIC DATA IN ESTIMATING STORAGE DAYS FOR SOILS TREATMENT SYSTEMS,
Environmental Data Service, Asheville, NC.
D. M. Whiting.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 597, Price codes: A05 in paper copy, A01 in microfiche. Report No. EPA-600/2-76-250, November, 1976. 90 p, 47 fig, 4 tab, 35 ref, 3 append.

Descriptors: *Storage capacity, *Computer programs, *Climatology, *Climatic data, *Soil treatment, Soil properties, *Land application, Cold-weather operations, Wet-region operations.

Computer programs which estimate storage needs for Soil Treatment Systems are developed from analyses of daily climatological data; the number of days each year that the systems may be inoperative because of unfavorable weather conditions can be estimated. Cold region winter seasons are examined for a 20-25 year period. Each day is defined as favorable, partly favorable, or unfavorable using a set of thresholds for temperature, precipitation, and snow depth. A daily accounting procedure adjusts in-storage increases and decreases on the basis of day, type and drawdown rate. Maximum storage days (each year) are summarized in a table, including mean, standard deviation, unbiased third moment about the mean, coefficient of skewness, and storage days for recurrence intervals of 5, 10, 25, and 50 years. A second program designed for use in wet regions where the primary constraint to land application is saturated soil is developed. Daily mean temperature and precipitation are examined for the same peiod, using the modified Palmer program which estimates the condition of the underlying and surface soil layers in order to identify periods when saturation occurs and runoff would result from additional precipitation or application. The longest consecutive period of unfavorable days each year is summarized in a table which also shows estimated storage days at 5, 10, 25, and 50th percentiles. Chronological listings of the actual data and computations for the entire period of record can be furnished. Thresholds of most of the parameters can be changed to suit individual systems. With modification, the program can examine conditions of the surface layer during the growing season as an estimate of irrigation needs. (Seip-IPA)
W78-05993

STUDIES ON THE PURIFICATION OF WASTES FROM THE NITROGEN FERTILIZER INDUSTRY BY INTENSIVE ALGAL CULTURES. IV. GROWTH OF CHLORELLA VULGARIS IN WASTES WITH HIGH NITROGEN CONTENT IN CONTINUOUS AND INTERMITTENT LIGHT,
Warsaw Univ. (Poland). Dept. of Environmental Microbiology.
For primary bibliographic entry see Field 5D.
W78-05997

OCEAN DUMPING: PHILADELPHIA'S STORY.
Environmental Science and Technology, Vol. 9, No. 10, p 916-917, October 1975. 1 fig.

Descriptors: *Philadelphia(PA), *Sewage disposal, *Ocean dumping, *Recycling, *Beneficial use, *Land reclamation, Heavy metals, Pennsylvania, Oceans, Waste disposal, Sludge disposal, Middle Atlantic Bight, Permits, Regulation, Fertilizers, Landfills, Water pollution sources, Water pollution control, Food chains, Strip mines, Toxins, Environmental Protection Agency, Public health, Epidemics.

The new EPA ocean dumping permit for Philadelphia's sewage, which requires the city to end all dumping by 1981, could have many beneficial consequences. The permit specifies that 1975 dumping must be held to the 1974 level (150 million gallons), and reduced 50% by 1979. The most desirable alternative to the current disposal system lies in using the sewage sludge to reclaim and revegetate the thousands of acres of active and abandoned strip mines in Pennsylvania. Sludge would promote growth of grasses, the most resistant of all plants to uptake of the heavy metals present in the sludge. As fertilizer, the sludge would be use-

ful for revegetating highway medians, golf courses, and parks. Sludge could be mined for its nutrient and heavy metal content at a net operating cost less than one-third the present cost of barging it to the dumping site 40 miles east of Ocean City, Maryland, in the Middle Atlantic Bight. Pathogens and other toxic sludge components present far greater hazards at sea than in terrestrial systems. Shellfish and other edible marine invertebrates are very prone to accumulate pathogenic microorganisms. Whereas there has never been an epidemic traceable to land sludge application, since 1900 there have been some 600 epidemics in the U.S. directly attributable to sewage discharge into water. Other toxic substances are also less hazardous on land because of the multiple barriers to biological uptake in terrestrial plants and soils which have no counterpart in marine systems. (Lynch-Wisconsin)
W78-06021

EFFECTS OF POLLUTION ON WATER QUALITY, PERDIDO RIVER AND BAY, ALABAMA AND FLORIDA.
Federal Water Pollution Administration, Athens, GA. Southeast Water Lab.
For primary bibliographic entry see Field 5C.
W78-06044

WATER QUALITY FACTORS, NORTH PLATTE RIVER, WYOMING-NEBRASKA.
National Field Investigations Center, Denver, CO.
For primary bibliographic entry see Field 5G.
W78-06049

ANALYSIS OF OPERATION 'DEEP SIX' BENTHIC INVERTEBRATES.
Marine Research Inc., Falmouth, MA.
For primary bibliographic entry see Field 5C.
W78-06052

A FIELD STUDY OF THE AGRICULTURAL USE OF SEWAGE SLUDGE: II. EFFECT ON SOIL N AND P,
Ball State Univ., Muncie, IN. Dept. of Natural Resources.
K. A. Kelling, L. M. Walsh, D. R. Keeney, J. A. Ryan, and A. E. Peterson.
Journal of Environmental Quality, Vol 6, No 4, p 345-352, October-December, 1977. 3 fig, 5 tab, 25 ref.

Descriptors: *Sludge disposal, *Land use, *Pollutant identification, *Nitrogen compounds, *Phosphorus, Groundwater, Nitrification, Denitrification, Leaching, Impaired water quality, Municipal wastes, Waste water treatment.

Changes in concentrations of soil inorganic N, organic N, and available P with time were examined at field sites in Arlington and Janesville, Wisconsin, which had been treated with digested sludge. Liquid digested sludge applied at rates of 3.75-60 metric tons/ha increased the concentrations of inorganic N, organic N, and available P in the sandy loam and silt loam soils. Most of the inorganic N in the digested sludge was in the form of NH4-N and was rapidly nitrified. At application rates of 30 metric tons/ha or higher, substantial amounts of sludge-applied N were lost by leaching. Concentrations of NO3-N in the soil water were over 100 mg/liter at a depth of 120-150 cm within 10 weeks after sludge application on permeable sandy loam and within about 1 year after application on silt loam. The N balance indicated that considerable N might have been lost via denitrification or volatilization at application rates over 30 metric tons/ha. As much as 50% of the organic N in the sludge was mineralized by 3 weeks after application, more than previously reported. During the following 25 months, the mineralization rate essentially remained at about 250 mg of organic N/kg of soil/year where 60 metric ton/ha had been applied and at 180 mg of organic N/kg of soil/year where 30 metric ton/ha had been applied. Sludge applications immediately increased the quantity of available P. The quantity of available P subsequently decreased with time, probably due to P fixation. Where higher treatment rates had been used, significant amounts of available P remained in the soil after 2 years. (See also W78-04609 and W78-06060) (Snyder-FIRL)
W78-06059

PLANNING FOR CLEANING UP AN ESTUARY--PART II: PHYSICAL PLANNING FOR THE MERSEY,
For primary bibliographic entry see Field 5G.
W78-06062

RECOVERY OF YEAST FROM CONFECTIONERY EFFLUENT,
Reading Univ., (England). Philip Lyle Memorial Research Lab.
For primary bibliographic entry see Field 5D.
W78-06070

HEAT RECOVERING INCINERATION OF ORGANIC EMISSIONS SAVES $970/000/YR IN FUEL COSTS,
Amoco Chemicals Corp., Joliet, IL.
W. W. Twaddle, C. Olson, and K. L. Kramer.
Chemical Processing, Vol. 41, No. 1, p 116-117, January, 1978. 1 fig.

Descriptors: *Chemical industry, *Incineration, *Organic compounds, *Thermal conductivity, *Chemical wastes, Heat transfer, Boilers, Steam, Oxidation, Design data, Waste treatment, Industrial wastes.

A Cor-Pak direct-flame fume incinerator, designed by C-E Air Preheater, Combustion Engineering, Inc of Wellsville, New York, is being used to provide heat for operations at Amoco Chemical Company's maleic anhydride plantin Joliet, Illinois. Tail gases from the maleic anhydride plant are preheated to 700F in the primary heat exchanger of the thermal oxidizer unit. The hydrocarbon-bearing gases are transferred to a combustion chamber where they are oxidized to carbon dioxide and water vapor by direct flame combustion and raised to a temperature of 1,400F. More than 46% of the heat is transferred from the tail gases to tube-encased fumes as the gases pass over a recuperative heat exchanger. Additional heat is removed as the gases are passed through a waste heat recovery boiler for the removal of steam. Residual gas is incinerated at 500F in stakes. The recovery boiler steam and oxidation heat provide all the heat necessary to operate the maleic anhydride plant, as well as excess steam to power other operations. An annual savings of energy costs has been estimated at more than $970,000. (Lisk-FIRL)
W78-06072

DISPOSAL OF WASTE-OILS AND PCB'S IN CEMENT KILNS,
Dundee Cement Co., MI.
T. Patzias.
Pit and Quarry, Vol. 70, No. 8, p 88-90, February, 1978. 6 ref.

Descriptors: *Polychlorinated biphenyls, *Oil wastes, *Cements, *Incineration, *Construction materials, Zinc, Lead, Bromine, Phosphorus, Waste water treatment, Waste disposal, Industrial wastes.

The incineration of waste oils and polychlorinated biphenyls was evaluated as a fuel source for cement kiln operations. Pilot-scale studies with automative crank case drainings were conducted at the St. Lawrence Cement Co. Ltd., of Ontario, Canada. The waste oil, containing small concentrations of lead, zinc, phosphorus, and bromine, was fed into the cement kiln at a rate of 8-12 gal/min under a pressure of 150 lbs/square inch. Incineration in the kiln with the waste oil resulted in better combustion of the active components; a 9% fuel savings was realized when compared to 1974 coal prices. Incineration of chlorinated hydrocarbons and polychlorinated biphenyls in pilot-scale cement kilns revealed a 99.98% combustion efficienty of the wastes in the production of low alkali cement. Emission samples contained 50 ppb of low molecular weight volatile compounds and no high molecular weight compounds, hydrochloric acid, or free chlorine. An estimated Btu recovery of 65% was realized from the incineration of these wastes. (Lisk-FIRL)
W78-06074

YEAST PRODUCTION ON SPENT SULPHITE LIQUOR,
Wilson Rowntree (Pty) Ltd., London (England).
For primary bibliographic entry see Field 5D.
W78-06078

EVALUATION OF LEACHATE CHARACTERISTICS AND PHYSICAL PROPERTIES OF COMPACTED MIXTURES OF FLY ASH AND WASTEWATER SLUDGE,
West Virginia Univ., Morgantown.
For primary bibliographic entry see Field 5B.
W78-06118

IDENTIFICATION OF RELEVANT CRITERIA AND SURVEY OF POTENTIAL APPLICATION SITES FOR ARTIFICIAL HABITAT CREATION, VOLUME I, RELEVANT CRITERIA FOR MARSH-ISLAND SITE SELECTION AND THEIR APPLICATION.
Coastal Zone Resources Corp., Wilmington, NC.
For primary bibliographic entry see Field 5G.
W78-06128

STUDIES ON THE CHARACTERISTICS AND DISPOSAL PROBLEMS OF INDUSTRIAL EFFLUENTS WITH REFERENCE TO ISI STANDARDS: (PART II),
D. A. V. Coll., Muzaffarnagar (India). Pollution Relevant Research Lab.
For primary bibliographic entry see Field 5G.
W78-06132

THE EFFECT OF THE SPRAY IRRIGATION OF SECONDARY TREATED EFFLUENT ON THE VEGETATION, SOILS AND GROUNDWATER QUALITY IN A NEW JERSEY PINE BARRENS HABITAT,
Rutgers - The State Univ., New Brunswick, NJ.
For primary bibliographic entry see Field 5B.
W78-06135

I. DYNAMICS OF MERCURY IN LAKE SEDIMENTS. II. STUDIES ON ORGANIC PHOSPHORUS IN SOILS IRRIGATED WITH MUNICIPAL WASTEWATERS,
Purdue Univ., Lafayette, IN.
For primary bibliographic entry see Field 5C.
W78-06137

RESOURCES ALLOCATION TO OPTIMIZE MINING POLLUTION CONTROL,
Ohio State Univ. Research Foundation, Columbus.
For primary bibliographic entry see Field 5G.
W78-06138

SEWAGE SLUDGE-SOIL SYSTEMS: A STUDY OF METAL FORMS AND EFFECT OF METALS ON CARBON AND NITROGEN TRANSFORMATIONS,
Purdue Univ., Lafayette, IN.
For primary bibliographic entry see Field 5C.
W78-06139

CHEMICAL ASPECTS OF GROUND WATER RECHARGE WITH WASTEWATERS,
California Univ., Berkeley.
For primary bibliographic entry see Field 5B.
W78-06141

EFFECTS OF ANAEROBICALLY DIGESTED MUNICIPAL SEWAGE SLUDGE APPLICATION ON CHEMICAL PROPERTIES OF SELECTED SOILS WITH EMPHASIS ON DISTRIBUTION OF ZINC AND CADMIUM FORMS,
Cornell Univ., Ithaca, NY.
For primary bibliographic entry see Field 5B.
W78-06173

SIMULATION OF WASTEWATER INJECTION INTO A COASTAL AQUIFER SYSTEM NEAR KAHULUI, MAUI, HAWAII,
Geological Survey, Reston, VA. Water Resources Div., and Geological Survey, Tallahassee, FL. Water Resources Div., and Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W78-06186

5F. Water Treatment and Quality Alteration

INCIDENCE OF ESOPHAGEAL CANCER IN THE GURYEV OBLAST DEPENDING ON THE MINERAL COMPOSITION OF THE DRINKING WATER, (IN RUSSIAN),
Kazakh Research Inst. Oncology Radiology, Alma Ata (USSR).
For primary bibliographic entry see Field 5G.
W78-05740

WATER FOR THE WEALTHY,
For primary bibliographic entry see Field 5G.
W78-05750

THE PHYSIOLOGICAL-HYGIENIC IMPORTANCE OF FLUORINE CONTENT IN DRINKING WATER, (IN RUSSIAN),
Kievskii Meditsinskii Inst. (USSR).
For primary bibliographic entry see Field 5C.
W78-05806

CHLORINATION AND OZONATION IN WATER AND WASTEWATER TREATMENT,
Pennsylvania Univ., Philadelphia. Dept. of Civil and Urban Engineering.
J. D. Keenan, and D. A. Hegemann.
Chemosphere, Vol. 7, No. 1, p 9-28, 1978. 2 fig, 51 ref.

Descriptors: *Chlorination, *Ozone, *Coliforms, *Potable water, *Odor, Taste, Water purification, Disinfection, Hydrogen sulfide, Biochemical oxygen demand, Chemical oxygen demand, Waste water treatment, Water treatment.

An evaluation based on chemical and biological factors cited in previous studies of chlorine and ozone as disinfection agents of waste water and potable water was presented. Chlorination of potable water was effective for the removal of tastes, odors, color, iron, and manganese. Chlroine was also found to control algal growth, slime growth, and hydrogen sulfide, and to improve activated silica precipitation. Studies in which the use of chlorine in waste water treatment was shown to produce potentially toxic chlorinated organics were cited. The production of chlorinated organics in waste water considered more serious than in potable water because of the larger number and concentrations of organics in waste water. Dechlorination was considered an expensive remedy for the effects of chlorination. Ozonation of waste water was found effective in the reduction of fecal coliform counts, odor, color, turbidity, organic pesticides, and the conversion of cyanide to a biodegradable level. Treatment with 60 ppm of ozone was required to reduce BOD levels; COD was reduced with more conventional ozone concentrations. Costs for ozonation and chlorination of waste water appeared compatible. An analysis of the chemical reactions occurring during ozonation and chlorination was presented. (Lisk-FIRL)
W78-05867

A MICRO-KJELDAHL TECHNIQUE FOR NITROGEN DETERMINATION IN WATER, WASTEWATER, AND SLUDGE,
Butler, Fairman and Seufert, Inc., Carmel, IN.
For primary bibliographic entry see Field 5A.
W78-05878

CANNING GROUP EXPANSIONS.
For primary bibliographic entry see Field 5D.
W78-05908

A MODIFIED PERCHLORINATION PROCEDURE FOR THE DETERMINATION OF POLYCHLORINATED BIPHENYLS,
Wisconsin Univ.-Madison. Water Chemistry Lab.
For primary bibliographic entry see Field 5A.
W78-05939

LEAD CONTAMINATION IN DRINKING WATER IN LJUBLIJANA, (IN SLOVENIAN),
For primary bibliographic entry see Field 5A.
W78-05981

THE COST OF REMOVING CHLOROFORM AND OTHER TRIHALOMETHANES FROM DRINKING WATER SUPPLIES,
Environmental Protection Agency, Cincinnati, OH. Office of Research and Development.
R. M. Clark, D. L. Guttman, J. L. Crawford, and J. A. Machisko.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 283, Price codes: A06 in paper copy, A01 in microfiche. Report No. EPA - 600/1-77-008, March, 1977. 97 p, 58 fig, 21 tab, 12 ref.

Descriptors: *Water treatment, *Disinfection, *Potable water, *Capital costs, *Operational costs, *Cost analysis, *Chlorination, *Activated carbon, *Ozone, *Aeration, Organic compounds, Planning, *Chloroform, *Trihalomethanes, *Chlorine dioxide, Ozonation, Carcinogens, Granular activated carbon.

The cost of several alternatives to chlorine use in the disinfection of drinking water are analyzed. Costs are assessed for chlorine, chlorine dioxide, and ozone as direct disinfection agents. The cost of aeration as a means of removing chloroform and other trihalomethanes (the potentially carcinogenic by-products of chlorination) is examined. An in-depth analysis of the costs associated with the use of granular activated carbon as a general means of removing organics is prepared; costs both with and without separate contractor systems and an examination of the possible cost savings associated with regional regeneration are included. The costs presented are intended for the development of planning estimates only and not for the preparation of bid documents or detailed cost estimates. Exact capital and operating costs are location-dependent and highly variable. Costs are presented to facilitate adjustments to the reported costs when local information is available. Standardized levels for a selected set of design parameters are assumed and sensitivity analysis is performed for the majority of the parameters. The values for 1, , 10, 100, and 150 mgd plants for all treatment alternatives examined are given in a table. Chlorination was found to be the cheapest of all the treatment technologies. (Seip - IPA)
W78-05988

RECOVERY OF LIME AND MAGNESIUM IN POTABLE WATER TREATMENT,
Black, Crow and Eisdness, Inc., Montgomery, AL.
C. G. Thompson, and G. A. Mooney.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 276, Price codes: A07 in paper copy, A01 in microfiche. Report No. EPA - 600/2-76-285, December, 1976. 119 p, 20 fig, 18 tab, 33 ref, 4 append. 5803194-01-4.

Descriptors: *Potable water, *Water treatment, *Water softening, *Magnesium carbonate, *Calcium carbonate, *Recycling, *Lime, *Flotation, Beneficiation, Capital costs, Operating costs, Cost analysis, Pilot plants, *Froth flotation.

Treatment of hard, turbid surface water using a magnesium carbonate (MgC03) process in a 2 mgd pilot plant in Water District No. 1, of Johnson County, Kansas was investigated; water quality equalled or exceeded that obtained with conventional treatment. Froth flotation was used to separate calcium carbonate (CaC03) formed in the treatment process from water softening sludges. Bench-scale and pilot plant flotation tests have shown that sludges formed by softening turbid water can be processed to yield a relatively pure CaC03 which is suitable for lime recovery. Lime recovery will drastically reduce the amount of water plant sludge for ultimate disposal. Process variables affecting both MgC03 recovery and CaC03 beneficiation were studied. MgC03 was recovered from the saturated magnesium bicarbonate recycle liquor; the cost per ton to produce relatively pure Mg0 was estimated to range from $147 to $185. A comparison of capital and operating costs for MgC03 treatment, sludge flotation, and lime recovery with present operating costs (including waste disposal) indicated that annual costs would be lower with the new technology; it is recommended that magnesium recycle, froth flotation, and lime recalcination be adopted at this plant. (Seip - IPA)
W78-05990

VIRUS PARTICLE AGGREGATION AND HALOGEN DISINFECTION OF WATER SUPPLIES,
North Carolina Univ. at Chapel Hill.
D. G. Sharp.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-266 358, Price codes: A04 in paper copy, A01 in microfiche. Report No. EPA-600/2-76-287, December, 1976. 49 p, 30 fig, 2 tab, 18 ref. R803771, DAMD17-17-A013.

Descriptors: *Aggregates, *Viruses, *Dispersion, *Disinfection, Chlorination, Bromine, *Halogens, Continuous flow, Sedimentation rates, Centrifugation, Pollutant identification, Water treatment, *Reovirus, *Poliovirus, Disinfection rates, Virus inactivation, 'Flash Flood' apparatus.

Bromine and chlorine disinfection of reovirus and poliovirus suspensions in water is investigated. When reovirus aggregates are present in water suspensions containing bromine, disinfection proceeds at a constantly de creasing rate which is determined by the frequency of the different aggregate sizes in the mixture. Both reoviruses and polioviruses in aggregated form are much more resistant to bromine and chlorine disinfection than single particles. The basic reaction rates for single virions can accurately be determined and compared by removing aggregates from the suspension; this is accomplished by sedimentation of the particles by centrifugation, taking advantage of aggregates' difference in sedimentation velocity. Poliovirus suspensions of single particles are about 25 times more resistant to bromine than similar suspensions of reovirus. Bromine destroys poliovirus a little faster than chlorine but both are very fast acting on single virions. The 'Flash Flood' apparatus allows the very short time expo-

sures required to determine the kinetics of single virion disinfection rates. Dilution of laboratory stock virus in water tends to aggregate it; special methods are described to detect aggregation at high dilutions. Problems inherent in the disinfection of natural and induced virus aggregate suspensions are identified. Specific recommendations for further research primarily address the problems of treating and/or dispersing virus aggregates effectively. (Seip - IPA)
W78-05991

EXPERIMENTAL EVALUATION OF OXYGEN AND AIR ACTIVATED SLUDGE NITRIFICATION SYSTEMS WITH AND WITHOUT PH CONTROL,
District of Columbia Dept. of Environmental Services, Washington. EPA-DC Pilot Plant.
For primary bibliographic entry see Field 5D.
W78-05992

MANUAL OF TREATMENT TECHNIQUES FOR MEETING THE INTERIM PRIMARY DRINKING WATER REGULATIONS.
Environmental Protection Agency, Cincinnati, OH. Office of Research and Development.
Report No. EPA - 600/8-77-005, May 19, 1977. 73 p, 55 fig, 17 tab, 108 ref.

Descriptors: *Potable water, *Water purification, *Water pollution treatment, *Cost analysis, *Disinfection, Turbidity, Radioactive wastes, Coliforms, Inorganic compounds, Organic pesticides, Monitoring, Diatomaceous earth, Filtration, Chlorination, Sludge disposal, Radium radioisotopes, Ion exchange, Arsenic compounds, Cadmium, Chromium, Fluorides, Lead, Mercury, 2,4-D, 2,4,5-T, Reverse osmosis, *Water quality standards, *Safe Drinking Water Act, National Interim Primary Drinking Water Regulations, Public Law 93-523, Barium, Selenium, Silver, Granular media filtration, Ion exchange softening, Lime-soda softening, Lime sludge disposal, Alpha emitters, Beta emitters, Photon emitters, Endrin, Lindane, Taxophene methoxyclor.

Treatment technologies for complying with maximum contaminant level (MCL) standards (as mandated by the 1974 Safe Drinking Water Act, National Interim Primary Drinking Water Regulations) for inorganic constituents, turbidity, coliform organisms, 6 pesticides, and radionuclides are presented. The descriptions are derived from literature and research conducted by the Water Supply Research Division and represent the technology that was known at the time the Interim Primary Drinking Water Regulations became effective. Cost estimations and references are included for each treatment category. The inorganic contaminants covered include: arsenic, barium, cadmium, chromium, fluoride, lead, mercury, nitrate, selenium, and silver. Granular media and diatomaceous earth filtration, used as techniques of turbidity removal, are discussed; filter plant sludge disposal procedures are outlined. The use of chlorine, ozone, and chlorine dioxide as disinfection agents in the removal of coliform organisms and turbidity and disinfection by-products are described. Pesticide (organic contaminant) removal methods for endrin, lindane, taxophene, 2,4-dichlorophenoxyacetic acid (2,4-D) 2,4,5-trichlorophenoxypropionic acid (2,4,5-TP (Silvex)), and methoxychlor are included. Radioactive contaminant removal procedures for alpha emitters (i.e., radium), and for beta and photon emitters are described. Radium removal methods (lime or lime-soda softening, ion exchange softening, and reverse osmosis), treatment water disposal processes (lime sludge, lime softening backwash, ion exchange brine, and reverse osmosis waste disposals), monitoring techniques and removal methods for manmade radioactivity are outlined. (Seip-IPA)
W78-05994

TEN YEARS OF WATER FLUORINATION IN IVANO-FRANKOVSK, (IN RUSSIAN),
Kievskii Meditsinskii Inst. (USSR).
R. D. Gabovich, G. A. Stepanenko, and P. M. Bur'yan.
Gig Sanit 11, p 22-26, 1976.

Descriptors: *Fluorination, Human diseases, Public health, *Dental caries, *Water treatment, Metab-Drug, *USSR(Ivano-Frankovsk).

Ten years of water fluorination in Ivano-Frankovsk (USSR) proved the high effectiveness of this measure against dental caries. The incidence of dental caries among children, who had used fluorinated water in the course of all their life, decreased by 73%. This is close to the fluorination effectiveness indices, previously described in using natural water with an optimum fluorine content.--Copyright 1978, Biological Abstracts, Inc.
W78-06024

PUBLIC WATER SUPPLIES OF NORTH CAROLINA, PART 5. SOUTHERN COASTAL PLAIN,
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 4A.
W78-06178

5G. Water Quality Control

MEASUREMENT OF SEDIMENT CONTROL IMPACTS ON AGRICULTURE,
Arizona Univ., Tucson. Dept. of Agricultural Economics.
J. C. Wade, and E. O. Heady.
Water Resources Research, Vol 14, No 1, p 1-8, February 1978. 2 fig, 5 tab, 13 ref.

Descriptors: *Sediment control, *Water pollution control, Impacts, *Agriculture, *Measurement, Parameter estimation, Soil loss, Optimization, Linear programming, Cost minimization, Policy, Land use, Mathematical models, Equations, Systems analysis.

Environmental policy has been explicitly expanded in order to consider nonpoint or dispersed sources of water pollutants. This study utilizes a national agricultural model to evaluate hypothetical policies of sediment control viewing the problem as primarily a national one of agricultural land use. A sediment sector is added to the basic Center for Agricultural and Rural Development-National Water Assessment model to test the impacts of sediment control policies on the agricultural production system. Costs of alternative control policies are analyzed; these costs are defined as the additional costs to agriculture of several alternative sediment control policies. Using linear programming, the minimum cost of the minimum feasible total sediment load is determined, a single restraint imposed at the national level. (Bell-Cornell)
W78-05701

THE TOXICITY OF CARBOPHOS FOR SOME HYDROBIONTS, (IN RUSSIAN),
Azovskii Nauchno-Issledovatelskii Inst. Rybnogo Khozyaistva, Rostov-na-Donu (USSR).
For primary bibliographic entry see Field 5C.
W78-05711

A MODEL CRITERION FOR SITE SELECTION OF LARGER SCALE TECHNICAL FACILITIES IN THE UPPER RHINE REGION,
Nuclear Research Center, Karlsruhe (West Germany).
G. Halbritter.
In: Mathematical Models for Environmental Problems. Proceedings of the International Conference held at the University of Southampton, England, September 8-12, 1975. C.A. Brebbia (Ed.), Department of Civil Engineering, Southampton University. John Wiley & Sons, N.Y., N.Y., 1976, p 55-69. 7 fig, 8 ref.

Descriptors: *Sites, *Evaluation, *Model studies, *Optimization, Rivers, *Project planning, *Water pollution control, Regional analysis, Economic efficiency, Costs, Constraints, *Powerplants, Environment, Ecology, Equations, Systems analysis, *Upper Rhine region(West Germany), Cost minimization, Pollution minimization, Objective functions, *Vector-valued optimization.

In dense'y populated Central Europe, projects necessitate site planning which incorporates pollution control, considering the site's specific environments, e.g., the density of settlements and the ecological situation. Although there are numerous methods available for evaluating pollution levels and for obtaining optimal siting, there is scarce information on suitable objective functions which ideally should deliver any one optimum solution. An investigation has been made which incorporates two requirements (which become the two objective functions): (1) the siting must guarantee a pollutant concentration which is inversely proportional to the population density; and (2) investment and operating costs must be minimized. The simultaneous handling of both requirements to find one solution is accomplished using vector-valued optimization, which attempts to maximize the sum of the objective attainment values put forward by the two requirements. Two models are presented, one for pollutant minimization and the other for cost minimization. A calculation of possible power plant sites in the 'Upper Rhine Region' is made. The regarded pollutant is sulphur dioxide. Four objective functions are considered here: (1) impact dependent upon population density; (2) minimum costs for the plants; (3) maximum power to be installed in the region; and (4) maximization of the objective attainments. (See also W78-05721 thru W78-05727) (Bell-Cornell)
W78-05720

OPTIMIZATION METHODS FOR PLANNING WASTE WATER MANAGEMENT SYSTEMS,
Karlsruhe Univ. (West Germany). Inst. fuer Siedlungswasserwirtschaft.
H. Orth, and W. Ahrens.
In: Mathematical Models for Environmental Problems. Proceedings of the International Conference, University of Southampton, England, Sept. 8-12, 1975. C.A. Brebbia (Ed.), Southampton University. John Wiley & Sons, N.Y., N.Y., p 99-113, 1976. 5 fig, 10 ref.

Descriptors: *Waste water(Pollution), *Management, *Optimization, *Model studies, *Regionalization problem, Planning, Algorithms, Computers, Cost minimization, Decomposition methods, Constraints, Storm water, Pipes, Pumping stations, Treatment facilities, Equations, Operations research.

In planning regional waste water systems, the trend is toward the formulation and solution of mathematical problems. Extended algorithms for optimization and high speed computers allow the solution of large and realistic problems. A combination of different techniques aids in finding more accurate solutions. Given herein is an overview of mathematical solutions to the so-called regionalization problem. Selected algorithms are described and the applicability of the proposed methods to two example studies is demonstrated: (1) the economic feasibility of the urban drainage and sewerage system of the city of Abidjan/Ivory Coast; and waste water planning for an area containing 16 communities in Edenkoben, Germany. A regionalization problem is defined an an optimization problem wherein a waste water collection and treatment system with minimal costs is to be determined within a certain region or planning area. Basic models for the regionalization problem

are presented and then are extended with respect to the practical aspects of dimensioning plants and canals. (See also W78-05720) (Bell-Cornell)
W78-05723

THE RECREATIONAL RESPONSE TO CHANGES IN WATER QUALITY: A SURVEY AND CRITIQUE,
Leicester Univ. (England). Public Sector Economics Research Centre.
R. K. Turner.
International Journal of Environmental Studies, Vol. 11, No. 2, p 91-98, 1977. 1 fig, 42 ref.

Descriptors: *Recreation demand, *Reviews, *Water pollution effects, *Model studies, Water quality control, Clawson-Knetch recreation demand model, Social aspects, Water quality indices, Parameters, Social participation, Recreation, Recreation facilities.

A critical review of the literature on methods of estimating recreational demand response to changing water quality conditions cites three basic problems caused by a lack of empirical data: (1) Links between water quality parameters and pollution discharge rates are poorly understood. (2) The relationship between water quality indexes and various recreational water uses is unclear, making use of recreation demand models difficult. (3) Little is known of participant recreation to changes in water quality parameters. Most early attempts to measure recreational losses or benefits were based on the distance-oriented demand curve model typified by the Clawson-Knetch approach. This approach relates recreation demand to price, the latter being represented by distance from the water site. Few of these studies included water quality as a factor.The Clawson-Knetch model theoretically could measure effects of water quality changes on demand, but only after the fact. The U. S. National Commission on Water Quality developed a 'perceived water quality index', but details are lacking. Another source indicates that algae constitutes the primary pollution indicator in public perception. Other aspects of recreation demand analysis include private land values and the Q (water quality) variable, public recreation expenditure valuation and the Q variable, interview techniques, and participation-probability models. (Lynch-Wisconsin)
W78-05728

TOWARDS AN ECOLOGICALLY-BASED ECONOMIC PHILOSOPHY,
Oceanic Inst. Waimanalo, Hawaii.
For primary bibliographic entry see Field 6B.
W78-05734

EFFECTS OF HYDRAULIC DREDGING ON THE ECOLOGY OF NATIVE TROUT POPULATIONS IN WISCONSIN SPRING PONDS,
Wisconsin Dept. of Natural Resources, Waupaca. Bureau of Research.
For primary bibliographic entry see Field 5C.
W78-05739

INCIDENCE OF ESOPHAGEAL CANCER IN THE GURYEV OBLAST DEPENDING ON THE MINERAL COMPOSITION OF THE DRINKING WATER, (IN RUSSIAN),
Kazakh Research Inst. Oncology Radiology, Alma Ata (USSR).
B. A. Nemenko, M. M. Moldakulova, and S. N. Zorina.
Vopr Onkol (Leningr) 22(9), p75-76, 1976.

Descriptors: Calcium, Carcinogens, Chlorides, Esophageal cancer, Human diseases, Magnesium, Minerals, *Molybdenum, Salinization, Sodium, Soils, Strontium, Sulfates, Potable water, Guryev Oblast(USSR), Public health, Saline soils.

No deficiency in environment and water, and soil salination with sulfates, chlorides, Mg, Na, Ca and Sr, are regarded as factors contributing to high incidence of esophageal cancer among the population.--Copyright 1977, Biological Abstracts, Inc.
W78-05740

ENVIRONMENTAL PROTECTION GUIDELINES FOR CONSTRUCTING PROJECTS,
East Bay Municipal Utility District, Oakland, CA.
For primary bibliographic entry see Field 6G.
W78-05742

MOSQUITOES OF MIDDLE AMERICA,
California Univ., Los Angeles.
For primary bibliographic entry see Field 4A.
W78-05743

COMBATING RIVER POLLUTION.
Proceedings of the Institution of Civil Engineers, Vol. 62, p 187-189, February 1977.

Descriptors: *Rivers, *Water pollution control, *England, *Water pollution sources, *Planning, Decision-making, Thames River(England), London(England), Eutrophication, Sewage disposal, Waste disposal, Effluents, Regional development, Urban drainage, Storm runoff, Non-structural alternatives.

An informal discussion by the Institution of Civil Engineers (Great Britain) focusses on river pollution control. Planning for waste disposal should be unified and the number of decision-making bodies reduced. The advent of regional authorities is a step forward. Uses of rivers, including for water supply, agriculture, industry, fisheries, and recreation, must be defined and the quality requirement established. Not all rivers can be simultaneously maintained at a high quality level, and some may have to be allowed to deteriorate. In large urban settings, it was considered beneficial to begin a sewer where a 'main' river ended. A clarification lake or lakes with retention times of 4-5 days might solve the problem of storm sewage. Coordination of urban drainage systems is primarily a financial problem. The problems of divided responsibilities for river systems are illustrated by conflicts between the Thames Water Authority (TWA) and Greater London Council (GLC). For accidental spillages, a policy of safety first, pollution second was adopted for dealing with unknown substances. Eutrophication, not currently a problem in Britain, may become one in the future. (Lynch-Wisconsin)
W78-05744

HARVESTING A NUISANCE,
Florida Univ., Gainesville.
For primary bibliographic entry see Field 4A.
W78-05745

WATER FOR THE WEALTHY,
J. Stein.
Environment, Vol. 19, No. 4, p 6-14, May 1977. 7 fig.

Descriptors: *Developing countries, *Human diseases, *Water supply, *Water pollution control, *Water quality control, Mosquitoes, Flies, Snails, Worms, Schistosomiasis, Filariasis, Malaria, Onchocerciasis, Typhoid, Cholera, Dysentery, Sanitary engineering, Waste treatment.

An assessment of the extent of waterborne human diseases in developing countries is followed by a discussion of water quality and disease control measures. Each year there are 250 million new cases of typhoid, cholera, amoebic dysentery, worm diseases, trachoma, sleeping sickness, schistosomiasis, filariasis, malaria, onchocerciasis, and other water-related diseases, and 25,000 people die from them each day. Causes are widespread and include pollution, water shortages, breeding of mosquitoes, flies, and snails. As many of these diseases are chronically debilitating rather than fatal, they often go untreated due to lack of public attention or money. Some 70% of the world population is without a safe and dependable water supply, particularly in rural areas. Many waterborne diseases could be controlled with safe water supplies; washing of hands and face could virtually eliminate the incidence of trachoma, and simple waste treatment could drastically reduce fecally-transmitted diseases. In rural areas a starting point should be a protected spring or well with a hand pump, followed as a next step by delivery of water to a public fountain or standpipe. While groundwater supplies are generally safe when properly located, surface water often needs treatment to make it safe; simple chlorination may be sufficient. Chemical, biological, and drug treatment measures are being used for disease control. (Lynch-Wisconsin)
W78-05750

GREAT LAKES FISH EGG AND LARVAE IDENTIFICATION: PROCEEDINGS OF A WORKSHOP, APRIL 19-21, 1976, ANN ARBOR, MICHIGAN.
National Power Plant Team, Ann Arbor, MI.
For primary bibliographic entry see Field 2H.
W78-05753

IDENTIFICATION OF LARVAL FISHES TAKEN FROM THE INSHORE WATERS OF SOUTHEASTERN LAKE MICHIGAN NEAR THE DONALD C. COOK NUCLEAR PLANT, 1973-1975,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
For primary bibliographic entry see Field 2H.
W78-05758

CHALLENGING EFFLUENT LIMITATIONS,
Morgan, Lewis and Bockius, Washington, DC.
K. A. Rubin.
Environmental Science and Technology, Vol. 11, No. 2, p 144-147, February 1977. 3 fig.

Descriptors: *Regulation, *Permits, Effluents, *Judicial decisions, *Water pollution control, *Legal aspects, Environmental Protection Agency, Industrial wastes, Federal Water Pollution Control Act Amendments of 1972, PL 92-500, Inorganic chemical industry, Chemical industry, Suspended solids.

Many effluent guidelines proposed by the U.S. Environmental Protection Agency (EPA) under provisions of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500) are being revised as a result of litigation. This paper discusses: (1) EPA's statutory mandate and the technologies it utilizes to set effluent standards applicable to a variety of industrial point sources; (2) the legal procedures for challenging EPA determinations; and (3) the technical evidence needed to support or challenge EPA determinations. A chromological history of the development of effluent limitations for the inorganic chemical industry, currently under review by the U.S. Supreme Court, is given to illustrate EPA's decision-making process. With the reevaluation of many of EPA's regulations, there are important opportunities to present additional technical data on limitations achievable by various industrial point-source categories. Under PL 92-500 existing dischargers must apply the 'best practicable control technology currently available' (BPCTCA) by July 1, 1983. EPA was directed to 'identify, in terms of amounts of constituents and chemical, physical and biological characteristics of pollutants, the degree of effluent reduction attainable.' New discharges must apply the 'best available demonstrated control technology.' Industries involved in litigation have

challenged EPA's authority, methodology, data, and procedures. (Lynch-Wisconsin)
W78-05759

VERMONT'S WATER RESOURCE RESEARCH NEEDS,
Vermont Univ., Burlington. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W78-05801

URBAN STORM WATER MANAGEMENT,
K. W. Moore.
Water and Pollution Control, Vol. 116, No. 2, p 18, 20, February, 1978. 1 fig.

Descriptors: *Storm water, *Runoff, *Urban drainage, *Urban runoff, *Rainfall-runoff relationships, Biochemical oxygen demand, Suspended solids, Storage tanks, Storm runoff, Storm drains, Waste water treatment, Municipal wastes.

The integration of storm water management into land use and urban sewerage planning is discussed. A study of a large drainage area indicated the need for more grassland and a storm water reservoir to bring about a 50% reduction in the quantity of runoff and a significant decrease in BOD and suspended solids. Assessment of drainage areas can result in a reduction of peak discharge and pollutant loading of receiving waters. Storm water management requires the identification of problems, a review of the existing system, and evaluation of the effects of storm drainage and runoff which might influence the development of rural property. The control of pollution sources, erosion, and flooding, and storm water treatment should be implemented. Data on storm water control and economic alternatives should be collected. Storm water treatment and flow control can be achieved by the use of ponds, settling and storage tanks, sewer inlet controls, gate and weir controls, and swirl concentrators. Computer programs are also available for the prediction of storm water levels. (Lisk-FIRL)
W78-05821

TOXIC WASTE DUMPING INCIDENT DEMONSTRATES SURVEILLANCE NEEDS.
Public Works, Vol. 108, No. 12, p 58-60, 82, 83, December, 1977. 1 fig, 1 tab.

Descriptors: *Chemical wastes, *Waste disposal, *Ohio River, *Treatment facilities, *Pollutant identification, Sewerage, Sewage treatment, Kentucky, Indiana, Analytical techniques, Municipal wastes, Waste water disposal, Waste water treatment.

Unauthorized dumping of highly toxic waste into a combined sewer by a Memphis, Tennessee, chemical manufacturing plant created serious problems for government entities in six states during March 1976. The chemical wastes, which had entered the collection system of the Louisville and Jefferson County Metropolitan Sewer District in Kentucky, resulted in the need for total by-passing to the Ohio River of sewage normally treated at the Morris Forman waste water treatment plant. The toxic compounds were identified as hexachlorocyclopentadiene and octachlorocyclopentadiene. Water treatment plants downstream at Evansville, Indiana, and at Henderson, Kentucky, were able to remove the toxins using Aqua Nuchar activated carbon obtained from the Chemical Division of Westvaco. Mount Vernon, Indiana, was forced, however, to ban usage of all drinking water. As a result of the dumping incident, some 24,000 ft of sewers in the northwestern Louisville area contained contaminated sludge. Preliminary tests had indicated that the wet air oxidation process developed by Zimpro Inc of Rothschild, Wisconsin, could effectively degrade the compounds into less toxic substances. Full-scale processing of the six million gallons of contaminated sludge was then initiated. Daily monitoring at waste water treatment plants with the use of on-site gas chromatograph scans to detect volatile organics was recommended to prevent reoccurrence of the dumping incident. (Snyder-FIRL)
W78-05825

SANITARY DISTRICT SOLVES SLUDGE REMOVAL PROBLEM.
Water and Sewage Works, Vol. 124, No. 12, p 54-55, December, 1977. 3 fig.

Descriptors: *Mechanical equipment, *Sludge, *Cleaning, *Vibrations, *Treatment facilities, Sewage treatment, Digestion tanks, Operation and maintenance, California, Municipal wastes, Waste water treatment.

The Los Angeles County Sanitary District has used flow aid devices to handle non-degradable wastes. The devices, usually used in industrial applications, included conveyor belt cleaners, pneumatic vibrators, and air cannons. The conveyor system, running at 100 ft/min, carries as much as nine tons of material per hour. The sticky material, which is removed periodically from the 31 digesters, is carried by 24-in wide rubber conveyors to hoppers for storage until it is hauled to a landfill. Three heavy-duty Clamp Mount Torsion Arm conveyor belt cleaners reduce manual cleanup requirements of the conveyor belts by 75%. The single blade counterbalance cleaners used previously had tended to bounce away from the moving belt when larger particles were encountered. Problems of waste buildup under the conveyor belt cleaners were solved with the installation of a small Martin Engineering Vibrolator ball-type vibrator on one of the dribble chutes. Six Martin Clamp Mount Torsion Arm belts cleaners have been ordered for the 36-in wide conveyor belts which handle centrifuge cakes. The installation of two Big Blaster air cannons on a waste loading hopper has made it possible to evacuate the hopper without prodding with a rod. The air cannons each expel 13.276 cu ft of air at 100 psig into the waste material through a 4-in diameter pipe. (Snyder-FIRL)
W78-05862

THE USE AND INTEGRATION OF GROUND AND SURFACE WATER MODELS IN THE 208 PLANNING PROCESS,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 5B.
W78-05895

SEWAGE EFFLUENT ON PASTURE SHOWS LITTLE EFFECT.
Water and Wastes Engineering, Vol. 14, No. 12, p 14, December, 1977.

Descriptors: *Return flow, *Sewage effluents, *Sewage treatment, *Waste water disposal, *Nitrogen, Irrigation water, Phosphorus, Carbon, Coliforms, Florida, Waste water treatment.

Supplementary irrigation with secondary treated sewage effluent has been shown to have little adverse affect on pasture land. Irrigation with sewage effluent in Lakeland, Florida, began in 1969 and averaged 25,000 gal/d per 30 acres of grazed pasture. Analyses of samples collected from nine monitor wells near the irrigation sight yielded low bacteria and coliform counts. Tests at four other monitor wells revealed the presence of fecal related bacteria. The pasture's water table varied 1.0-3.3 ft below the land surface. Percolation to a depth of 8 ft yielded a nitrogen concentration of less than 20% of the effluent nitrogen. Negligible increases of nitrogen were found at a depth of 20 ft and in down-gradient groundwater. A geological survey conducted by the Water Resources Division of Tallahassee, Florida, produced no evidence of groundwater contamination by carbon or phosphorus. (Lisk-FIRL)
W78-05898

POLLUTION CONTROL PLANT STATISTICS.
Water and Pollution Control, Vol 115, No 11, p 78-96, 98, 101-102, November, 1977. 13 tab.

Descriptors: *Treatment facilities, *Sewage treatment, *Statistics, *Canada, *Sewerage, Biological treatment, Biochemical oxygen demand, Suspended solids, Sludge treatment, Lagoons, Aeration, Aerobic treatment, Activated sludge, Filtration, Municipal wastes, Industrial wastes, Water pollution control, Waste water treatment.

A comprehensive listing of Canadian municipal water pollution control facilities is provided in tabular form. The information given for each facility includes population size, whether the municipality was an industrial waste strength limiting by-law, average daily flow, and whether the system is separate or combined. Information on the degree of treatment, influent and effluent BOD and suspended solids, type of treatment, sludge processing, and cost of treatment per million gallons of waste water processed is also provided. Types of treatment covered include: algae lagoons, aerated lagoons, anerobic lagoons, primary sedimentation, conventional activated sludge, completely mixed systems, contact stabilization, biological filtration, extended aeration, and septic tanks. Sludge processing techniques include: heated digesters, drying beds, filtration, centrifuging, agricultural disposal, unheated digesters, incineration, liquid haulage, deep well disposal, and land-filling. Selected listings of key management and operating personnel responsible for pollution control at various locations in Canada are also provided. (Snyder-FIRL)
W78-05909

THE WHITE AMUR AS A BIOLOGICAL CONTROL FOR AQUATIC WEEDS IN INDIANA,
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 4A.
W78-05936

OIL TANKER DISASTERS,
South Carolina Univ., Columbia. Div. of Coastal Research.
E. R. Gundlach.
Environment, Vol. 19, No. 9, December 1977, 16-20 and 25-27, 7 fig, 44 ref.

Descriptors: Environmental effects, *Water pollution control, *Oil pollution, Oil, Oil industry, *Oil spills.

Case histories of massive oil spills from tankers and offshore drilling operations and the environmental consequences of these spills are reviewed. The impact of oil spills on the environment is highly variable. The coastal zone with its striking biological productivity is most likely to be severely damaged during a spill, while offshore incidents seem to cause only minor environmental impairment. The season in which the spill occurs also is influential in determining the extent of biological damage. During the spring reproductive period, a spill can be particularly injurious. The toxicity of petroleum varies greatly among crude and processed oils, depending on the hydrocarbon components. Plans and equipment for implementation in future oil spills are discussed. (Chilton-ORNL)
W78-05965

EUTROPHICATION IN VERMONT,
Vermont Dept. of Water Resources, Montpelier. Water Quality Div.
For primary bibliographic entry see Field 5C.
W78-05977

EUTROPHICATION AND WATER POLLUTION,
Federal Water Pollution Control Administration, Washington, DC.
For primary bibliographic entry see Field 5C.
W78-05982

THE PERMISSIBLE CONCENTRATION OF LEAD IN WATER, (IN RUSSIAN),
Akademiya Nauk Turkmenskoi SSR, Ashkhabad. Inst. of Physiology and Experimental Pathology Arid Zone.
O. G. Charyev.
Izv Akad Nauk Turkm Ssr Ser Biol Nauk 6, p 78-83, 1976.

Descriptors: *Toxicity, *Lead, Rodents, *Lethal limit, *Water quality standards, Water pollution effects.

Administration of lead acetate to albino rates showed that the general toxic and the gonadotoxic effects occur at the same dose level. A concentration of 0.03 mg/l Pb in water is recommended.--Copyright 1978, Biological Abstracts, Inc.
W78-05989

MANUAL OF TREATMENT TECHNIQUES FOR MEETING THE INTERIM PRIMARY DRINKING WATER REGULATIONS.
Environmental Protection Agency, Cincinnati, OH. Office of Research and Development.
For primary bibliographic entry see Field 5F.
W78-05994

RELATIVE TOXICITY IN WATER QUALITY PLANNING,
Anglian Water Authority, Huntingdon (England). Directorate of Scientific Services.
P. J. Matthews.
Effluent and Water Treatment Journal, Vol. 17, No. 1, p 16-18, January 1977. 1 tab, 16 ref.

Descriptors: *Water pollution control, *Toxicity, Relative toxicity, *Water quality indices, *Planning, *Water quality control, *Water pollution sources, Water management(Applied), Pollutants, Effluents, Fish, Lethal limit, Hydrologic cycle, Mathematical models, Sewage treatment.

A technique is suggested for measuring the total effects of pollutant discharges to the water cycle; it involves summation of individual species concentrations expressed as ratios of such concentrations to the limiting concentration for a given quality function. Individual and summed ratios are termed relative toxicities; the relative toxicity for a given situation which would normally be one or less, could form the basis for an index system usable in mathematical models. By reducing summed toxicological effects to the same comparative index, water quality planning can be simplified and critical situations more easily identified. Interpretation of BOD, fish toxicity, and sewage treatment toxicity is also facilitated. Potential adverse effects of substances in the water cycle can be classified as follows: (1) sewers--atmospheric, corrosive, and blockages/scum formation; (2) sewage treatment works--overload, microorganism activity, and sludge disposal; (3) surface waters, rivers, groundwater--macroflora and microflora toxicity, macrofauna and microfauna toxicity, and reduced availability to other uses; and (4) potable water--treatability of raw water and reduction of potability. Discharge substances may act independently, additively, synergistically, or antagonistically. Several examples of useful relative toxicities are discussed: (1) relative atmospheric toxicity, (2) relative fish toxicity, (3) relative phytotoxicity in soils, and (4) relative anaerobic toxicity. (Lynch-Wisconsin)
W78-05996

ROLE OF AUTOCHTHONOUS BACTERIA IN THE REMOVAL OF SPILLED OIL FROM SEDIMENT,
Maryland Univ., College Park. Dept. of Microbiology.
J. D. Walker, and R. R. Colwell.
Environmental Pollution, Vol. 12, No. 1, p 51-56, January 1977. 1 fig, 1 tab, 17 ref. N00014-67-0237-0027-Office of Naval Research Contract.

Descriptors: *Bacteria, *Biodegradation, *Oil spills, *Sediments, *Colgate Creek(MD), Degradation(Decomposition), Streams, Maryland, Baltimore harbor(MD), Chesapeake Bay, Estuaries, Sediment-water interfaces, Oil pollution.

Microbial degradation by indigenous bacteria seems responsible for a reduction of spilled oil observed in water and sediment samples taken from Colgate Creek, in Baltimore Harbor of Chesapeake Bay. The creek is exposed to continuous oil pollution from tank washings, accidental spills, and storm sewer effluent discharges. The amount of oil extracted from the samples, collected between January-September 1974, varied from month to month and was influenced by periodic spills. Increases in benzene-extractable material in the sediments were noted in March (fuel oil spills), May (Bunker C oil spills), and August (crude oil spill). No corresponding increases were detected in the water in the March and August spills, suggesting adsorption of oil onto particulate matter, followed by sedimentation, or rapid degradation by bacteria present in the water column. The Bunker C spill, on the other hand, was contained by an oil boom, providing a continuous wash of oil from the spill. A 75% decrease in benzene-extractable material in sediment samples was observed one month after each of the spills, due to two possibilities: (1) the flushing action of the Chesapeake Bay estuarine system, and (2) microbiological degradation. Laboratory testing of bacteria extracted from Colgate Creek water and sediment and exposed to oil concentrations resulted in biodegradation of about 70% of benzene extractables. Complex ecological events, such as microbial succession and rates of biodegradation during removal of the oil, should be properly assessed. (Lynch-Wisconsin)
W78-06012

NITRIFICATION IN RUNNING WATERS: CASE STUDY GLATT, (IN GERMAN),
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
For primary bibliographic entry see Field 5B.
W78-06015

TURBINE ASPIRATION FOR OXYGEN SUPPLEMENTATION,
Alabama Univ., University. Dept. of Engineering Mechanics.
D. C. Raney.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 103, No. 2, p 341-352, April 1977. 12 fig, 2 tab, 4 ref.

Descriptors: *Turbines, *Hydraulic turbines, *Dissolved oxygen, *Aspiration, *Aeration, *Hydroelectric plants, Oxygen, Reservoirs, Thermal stratification, Model studies, Equations, Prototype tests, Costs, Alternative costs, Alabama.

Aspiration-flow aeration systems for hydroelectric turbines to increase dissolved oxygen levels in discharges are described. One type of system uses deflector plates to produce localized regions of negative gage pressure in the draft tube: a second type takes advantage of natural negative pressures in the draft tube to achieve the desired aspiration flow. The investigation involved three phases: (1) a model study to obtain basic design data; (2) design of prototype aspiration systems; (3) prototype data acquisition to verify predicted operation characteristics. Aeration systems introduce air or molecular oxygen inot the penstock or draft tube of the turbine, and in the systems described here turbine hydraulics are used to induce an aspiration flow from the atmosphere into the draft tube. The cost per ton of dissolved oxygen added to the water in the aspiration system compares favorably with costs for molecular oxygen injection, diffusion systems, and other techniques. The modelling parameter and calculation procedures for the deflector plate concept were verified by comparison with measured flow rates for prototype systems installed on 10 turbines of the Alabama Power Company system located on the Warrior and Coosa Rivers. Data obtained from the natural aspiration tests were consistent and appear to yield a logical modelling relationship, but the modelling procedure has not been verified due to a lack of prototype data. (Lynch-Wisconsin)
W78-06017

THE BIOGENIC CARBON BALANCE IN A GROUND WATER INFILTRATION ENRICHMENT SYSTEM, (IN RUSSIAN),
Academy of Municipal Economy, Moscow (USSR). Research Inst. of Public Water Supply, Water Purification.
For primary bibliographic entry see Field 5B.
W78-06030

HEAVY HANDS ON THE POLLUTION CONTROLS,
Harvard Univ., Boston, MA. Graduate School of Business Administration.
R. Leone.
The Wharton Magazine, Vol 1, No 1, p 26-30, 1976. 3 ref.

Descriptors: *Legal aspects, *Water pollution control, *Non-structural alternatives, Water policy, Institutional constraints, Pollution abatement, Law enforcement, Penalties(Legal), Pollution taxes(Charges), Economics, Economic efficiency, Social values.

Pollution laws do not establish standards that can be applied equally to all industries. In addition, they are not geared to specific socially desirable goals, but rather towards whatever focus happens to be technically and economical feasible at the time. Technical and economic feasibility as primary guidances in pollution control lawmaking create short-term solutions which in turn discourage radical technological innovations that would be more effective and less costly in the long run. Today's pollution laws adversely effect not only the rate and direction of technical advance but also the nature of industrial competition, financial conditioning of companies, and basic marketing strategies. Pollution control laws are beneficial where they cause re-evalution of processing techniques that were previously considered uneconomic, or cause marginal plants to remain profitable by reducing effective capacities of large companies. Five suggestions are offered for industries wanting to reduce burdens of complying with environmental legislation: (1) educate government and the public as to the dynamic and competitive consequences of environmental control; (2) exploit competitive advantages; (3) cut the cost of pollution control by modifying either the product or the manufacturing process; (4) make money on pollution control by creating a self-cleanup capability; (5) anticipate future environmental requirements. (Harris-Wisconsin)
W78-06031

HYGIENIC ASSESSMENT OF BIOLOGICAL FISH PONDS USED FOR PURIFICATION OF SEWAGE FROM LIVESTOCK FARMS, (IN RUSSIAN),
All Union Research Inst. of Animal Husbandry, Dubrovitsy (USSR).
For primary bibliographic entry see Field 5D.
W78-06032

FEDERAL LAKE ERIE WATER QUALITY STANDARDS PROPOSALS.
Environmental Protection Agency, Region V, Chicago, IL.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-257 608, Price codes: A03 in paper copy, A01 in microfiche. June 1972. 32 p, 3 fig, 7 tab, 14 ref.

Descriptors: *Lake Erie, *Water quality standards, *Effluents, *Waste disposal, Regulation, Environmental Protection Agency, Federal Water Pollution Control Act, Great Lakes, Michigan, Ohio, Pennsylvania, New York, Water pollution control, Pollutants, Nutrients, Coliforms, Dissolved oxygen, Chlorine, Chemical wastes, Water temperature, Radioactivity, Hydrogen ion concentration.

Proposed water quality standards for Lake Erie are presented by the U. S. Environmental Protection Agency for consideration and action by Michigan, Ohio, Pennsylvania, and New York. Section 10 of the Federal Water Pollution Control Act allows each such lake-side state to adopt water quality criteria subject to EPA approval. General criteria require that Lake Erie waters be free from substances entering the waters as a result of human activity in the form of: those which ettle to form putrescent or otherwise objectionable sludge deposits, or that adversely affect aquatic life or waterfowl; (2) floating debris, oil, scum, and other floating materials in amounts sufficient to be unsightly or delcterious; (3) substances producing color, odor, or other conditions in such a degree as to create a nuisance; (4) substances in concentrations toxic or harmful to human, animal, or aquatic life; and (5) nutrients in concentrations sufficient to create nuisance growths of aquatic weeds and algae. More specific criteria include: (1) Fecal coliform organisms shall not exceed 200/100 ml based upon not less than 5 samples/mo, nor shall any sample exceed 400/100 ml. (2) Dissolved oxygen shall not be below 80% saturation nor be less than 6 mg/l. (3) Chlorine concentrations shall not exceed 0.002 mg/l. (4) The range of pH shall be 6.7-8.5. Specifications are also given for radioactivity, mixing zones, chemical constituents, and temperature. (Lynch-Wisconsin)
W78-06048

WATER QUALITY FACTORS, NORTH PLATTE RIVER, WYOMING-NEBRASKA.
National Field Investigations Center, Denver, CO.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 668, Price codes: A03 in paper copy, A01 in microfiche. October 1971. 29 p, 2 fig, 2 tab, 10 ref, 2 append.

Descriptors: *North Platte River(Wyo-Neb), *Water quality standards, *Water disposal, *Effluents, Sugar beets, *Wyoming, *Nebraska, Regulation, Holly Sugar Corporation, Legal aspects, Industrial wastes, Permits, Agricultural runoff, Municipal wastes, Irrigation effects, Federal Water Pollution Control Act, Waste treatment, Color, Turbidity.

Water quality, pollution sources, applicable regulations, and enforcement history of the North Platte River in Wyoming and Nebraska are described. Water quality was most severely degraded in 1960-61 during the sugar beet processing season, when river water was characterized by high basic oxygen demand (61 mg/l maximum), low dissolved oxygen levels (a minimum of 4.3 mg/l), high suspended solids and turbidity, and high bacterial counts (a maximum over 1 million total coliforms/100 ml). Water quality standards set in 1967 by Wyoming and Nebraska in accordance with the Federal Water Quality Act of 1965 were violated in 1970 by the Holly Sugar Corporation at Torrington, Wyoming. Stringent waste treatment requirements were established, with complete abatement to be achieved prior to the 1972-73 sugar beet processing season. Waste treatment facilities at four Great Western Sugar Company refineries located in Nebraska will not meet requirements set for Holly Sugar. A waste source and water quality survey of the river between Torrington and Broadwater, Nebraska is needed during the sugar beet processing season to define impact on water quality of waste discharges, to evaluate present disposal practices, and to define waste treatment needs. Agriculture is the dominant industry in the valley; important irrigation crops are sugar beets, alfalfa, corn, and other feed corps. Under provisions of the Refuse Act of 1899, a major program has been initiated to issue permits for all discharges of industrial wastes to navigable waters. (Lynch-Wisconsin)
W78-06049

PLANNING FOR CLEANING UP AN ESTUARY--PART II: PHYSICAL PLANNING FOR THE MERSEY,
R. L. Gouge, G. L. Symes, and A. D. Buckley.
Journal of the Institution of Water Engineers and Scientists, Vol. 31, No. 5, p 329-350, September, 1977. 8 fig, 2 tab, 11 ref.

Descriptors: *Dissolved oxygen, *Estuaries, *Rivers, *Sewage effluents, *Municipal wastes, Treatment facilities, Sewage treatment, Sedimentation, Industrial wastes, Waste water treatment, Sewage disposal, *Mersey estuary(England).

Proposals for alleviating the discharge of pollutants into rivers which flow into the Mersey estuary in England are presented. Pollution in the lower reaches of the Mersey estuary consists of the deposition of sewage solids, oils, and fats on the beaches and foreshore. This area also receives approximately 330 megaliters/day of untreated sewage during dry weather flow. Selection of a sewage treatment site to process the sewage from the municipality of Liverpool and the expansion of the existing treatment facilities is recommended. The construction of a treatment plant at Wirral, on the other side of the estuary, is suggested. More ecomonically feasible are the proposals for expanding the drainage area of the sea outfall or construction another 5-m outfall. Screening of the effluent discharged by the outfalls and digestion plants for the treatment of raw sludge are also recommended. Contributing streams and industrial plants are the major sources of pollution in the upper areas of the estuary. Effluent discharged into the upper estuary has received primary or full treatment but still has a low dissolved oxygen content. Provision for primary sewage treatment is recommended for Widness. The addition of secondary treatment for areas with only primary treatment facilities is suggested by either construction of facilities or transfer of sewage to a secondary plant. The addition of oxygen to upper estuary waters and the installation of a nitrifying plant are also considered. (Lisk-FIRL)
W78-06062

REVIEW AND APPRAISAL OF NUMERICAL CIRCULATION MODELS FOR LAKE MICHIGAN,
Argonne National Lab., IL. Energy and Environmental Systems Div.
For primary bibliographic entry see Field 2H.
W78-06122

THE EFFECT OF MILITARY TRANSPORTATION ACTIVITIES ON THE ENVIRONMENT,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Mobility and Environmental Systems Lab.
For primary bibliographic entry see Field 4C.
W78-06126

EROSION AND SEDIMENT CONTROL. SURFACE MINING IN THE EASTERN U.S. VOLUME I. PLANNING. VOLUME II. DESIGN,
Hittman Associates, Inc., Columbia, MD.
T. R. Mills, and M. L. Clar.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-261 343, Price codes: A12 in paper copy, A01 in microfiche. Report EPA-625/3-76-006, October 1976. 243 p, 124 fig, 39 tab, 34 ref. EPA 68-03-2213.

Descriptors: *Erosion control, *Strip mines, *Sediments, *Erosion, Bank protection, Bank stability, Check structures, Cover crops, Vegetation, Land forming, Riprap, Roadbanks, Slope protection, Soil stabilization, Vegetation establishment, Watershed management, Erosion rates, Mining, Coal mines, Water quality, Water pollution, *Eastern US.

An evaluation is presented of the effectiveness of sediment ponds in reducing suspended solids in the runoff from surface mining activities. Nine selected sedimentation ponds in the three eastern coal-mining states of Pennsylvania, West Virginia, and Kentucky were sampled under two different operating conditions, a baseline and rainfall event. The theoretical and actual efficiencies of removal of suspended solids were computed and compared. (Sims-ISWS)
W78-06127

IDENTIFICATION OF RELEVANT CRITERIA AND SURVEY OF POTENTIAL APPLICATION SITES FOR ARTIFICIAL HABITAT CREATION, VOLUME I, RELEVANT CRITERIA FOR MARSH-ISLAND SITE SELECTION AND THEIR APPLICATION.
Coastal Zone Resources Corp., Wilmington, NC.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-033 525, Price codes: A10 in paper copy, A01 in microfiche. Army Engineer Waterways Experiment Station Contract Report D-76-2, Volume I, October 1976. 173 p, 26 fig, 9 tab, 130 ref. Army DACW 39-73-C-0116(Neg).

Descriptors: *Dredging, *Spoil banks, *Marshes, *Habitats, Wetlands, Shorelin cover, Vegetation, Vegetation establishment, Salt marshes, Coastal marshes, Islands, Sediments, Coasts, Estuaries, Artificial marsh construction, Dredged materials, Disposal site selection, Artificial habitats.

A process is developed for the selection of areas appropriate for artificial marsh construction using dredged material. By application of the methodology set forth, Engineer District personnel will be able to identify such areas efficiently. In Volume I of the report, the biophysical and socioeconomic information needed to evaluate potential marsh creation sites was described, and the rationale for the importance of such data was presented. A two-scaled approach to analyzing the information base typically available to the Engineer District was detailed. Specific kinds of problems that might arise and theoretical approaches to their solution also were discussed. The selection rational was tested in Volume II by the choice and description of 50 prime candidate project areas, 10 within each of 5 major coastal geographical regions. From this compilation, 10 optimum project areas, 2 in each geographical region, were selected and described further using data gathered in the project areas and from relevant Engineer Districts. (Sims-ISWS)
W78-06128

STUDIES ON THE CHARACTERISTICS AND DISPOSAL PROBLEMS OF INDUSTRIAL EFFLUENTS WITH REFERENCE TO ISI STANDARDS: (PART II),
D. A. V. Coll., Muzaffarnagar (India). Pollution Relevant Research Lab.
S. R. Verma, A. K. Tyagi, and R. C. Dalela.
Indian Journal of Environmental Health, Vol 19, No 3, p 165-175, 1977. 6 tab, 17 ref.

Descriptors: *Food processing industry, *Textiles, *Fertilizers, *Biochemical oxygen demand, *Suspended solids, Dissolved oxygen,

Nitrogen, Chemical oxygen demand, Phosphates, Chromium, Iron, Waste water disposal, Industrial wastes.

The Indian Standards Institute's industrial wastes discharge limitations were compared to the effluent characteristics of wastes discharged by various Indian industries. Samples of wastes from textile mills, fertilizer plants, antibiotic manufacturers, breweries, and slaughter houses were analyzed for a variety of parameters, including: odor, color, temperature, solids, pH, dissolved oxygen, BOD, COD, and nitrogen. Effluent parameters were found to exceed the Indian Standards Institute's tolerance levels in many instances. Untreated wastes from antibiotic production and slaughterhouse operations contained levels of BOD which exceeded standards. Textile wastes contained a high volume of suspended solids and were highly colored because of the presence of iron and chromium compounds. High concentrations of nitrogen, chloride, phosphate, and sulfate compounds were found in fertilizer wastes. Brewery effluent was acidic and contained high levels of suspended solids. Further biological or chemical treatment of the wastes was recommended before discharge into public water sources, land areas, or sewage treatment facilities. (Lisk-FIRL)
W78-06132

RESOURCES ALLOCATION TO OPTIMIZE MINING POLLUTION CONTROL,
Ohio State Univ. Research Foundation, Columbus.
K. S. Shumate, E. E. Smith, V. T. Ricca, and G. M. Clark.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 185, Price codes: A21 in paper copy, A01 in microfiche. Report No EPA-600/2-76-112, November 1976. 476 p, 69 fig, 40 tab, 7 ref, 4 append. EHE 623 05-01-08A-05. 68-01-0724.

Descriptors: *Resource allocation, *Acid mine water, *Mine drainage, *Coal mine wastes, *Model studies, *Optimization, Mine wastes, Water pollution control, Computer programs, Watersheds(Basins), Costs, Economics, Water pollution sources.

In determining cost-effective actions to eliminate or abate acid mine drainage from coal mining operations, a computer-based model was developed to describe or predict drainage acidity from deep and surface mines and from coal refuse piles. The model can: (1) produce a time trace of acid load and flow from acid drainage sources as a function of climatic conditions; (2) generate continuous receiving stream flow data from precipitation data; (3) predict acid load and flow from mine drainage sources using precipitation patterns and watershed status typical of worst-case conditions; and (4) predict optimum resource allocation using alternative treatment methods for worst-case conditions during both wet and dry periods of the hydrologic year. Knowing the acid load from each source as a function of time, costs of alternative mine drainage treatment techniques can be estimated, together with their effectiveness in reducing unabated acid loads. Alternative cost and effectiveness estimates for the individual acid sources are then used as input to an optimization model, which can be used to calculate the minimum cost for a given level of abatement in the watershed, or the maximum water quality attainable for a given cost. In most cases the field data required as input to the model are not currently available, and the model has not been fully tested or compared to real systems, nor has sensitivity to input data been determined. (Lynch-Wisconsin)
W78-06138

AERATION/CIRCULATION KEEPS ALGAL BLOOMS IN CHECK,
Tetra Tech, Inc., Lafayette, CA.
M. W. Lorenzen.
Water and Wastes Engineer, Vol. 14, No. 10, October 1977, p 69-74. 3 fig, 1 tab. EPA 68-03-2192.

Descriptors: *Lake rehabilitation, *Aeration, *Circulation, *Algal control, *Eutrophication, *Destratification, Lakes, Reservoirs, *Water pollution control, Water management(Applied), Mixing, Hydrogen ion concentration, Hypolimnion, Epilimnion, Thermocline, Stratification, Depth, Light penetration, Dominance.

Part 1 of a two-part series includes general considerations of aeration/circulation for algal control in lakes, reservoirs, and lagoons. Artificial mixing or destratification of a water body is used for aeration and for algal bloom control. Anoxic conditions develop in the hypolimnion under stratified conditions because the thermocline largely prevents downward transport of oxygen, and aeration may be necessary to safeguard fisheries and other biological communities, and to control odor and high iron and manganese buildups. Destratification for algal control requires high energy systems to redistribute algal cells throughout the water column. Algal blooms are controlled as the amount of sunlight available for photosynthesis is limited; depth available for mixing is a controlling factor in limiting algal biomass. Lowering the pH through mixing may favor non-cyanophyte species as well. The probable net long-term effect of maintaining oxic conditions would be reduction in sediment phosphorus release. Results of artificial mixing in 19 lakes using compressed air for mixing are presented in tabular form. Successful systems generally used 1 standard cu ft/min (SCFM) of air per million cu ft of lake volume, and 20 SCFM air/million sq ft of surface area. Mechanical systems discussed include jet discharges, gasoline pump, 42-in fan blade, and 16.5 ft propellor. A procedure is given for determining suitability of an impoundment for destratification. (Lynch-Wisconsin)
W78-06140

COOLING DISCONTINUOUS WATERS WITH A SINGLE REFRIGERATION UNIT,
Arizona Univ., Tucson. School of Renewable Natural Resources; and Arizona Cooperative Fishery Research Unit.
F. W. Robinson, J. C. Tash, and S. H. Holanov.
The Progressive Fish Culturist, Vol. 40, No. 1, p 15, 1978. 2 fig.

Descriptors: *Laboratory equipment, *Refrigeration, *Cooling, *Water cooling, *Temperature control, *Water temperature, *Pumps, *Aquaria, Design, Equipment, Bioassay, Methodology.

A method of cooling water in toxicity bioassay experiments that require discontinuous waters was presented. This type of refrigeration unit is desirable in experiments in which the prevention of an exchange of dissolved substances is essential. The materials for construction cost approximately $50. (Dael-EIS)
W78-06146

THE TREATABILITY OF LEACHATES FROM SANITARY LANDFILLS,
Drexel Univ., Philadelphia, PA. Coll. of Business Administration.
For primary bibliographic entry see Field 5D.
W78-06148

SUMMARY OF DRAFT 201 FACILITY PLAN FOR UPGRADING METRO PUGET SOUND PLANTS,
Metropolitan Engineers, Seattle, WA.
R. C. Bain, Jr.
Municipality of Metropolitan Seattle, Wash., (Sept. 1977). 60 p, 10 fig, 11 tab.

Descriptors: *Water Quality Standards, *Regulation, *Sewage treatment, *Sewage effluents, *Sewage sludge, *Sanitary engineering, *Waste water treatment, *Urban runoff, *Federal Water Pollution Control Act, *Municipal wastes, *Domestic wastes, *Washington, Puget Sound, Seattle, Marine waste disposal, Lake Washington.

The Metropolitan Seattle area is required by federal law to institute secondary sewage treatment by 1983. This report addresses the four major issues, viz, the specifications of the federal law, economic impact, environmental impact, and water quality. Eight alternative plans are then presented. (Dael-EIS)
W78-06149

MAINTENANCE OF A TROUT FISHERY BY AERATION IN A EUTROPHIC LAKE,
Adelphi Univ., Oakdale, NY. Inst. of Marine Science; and Adelphi Univ., Garden City, NY.
M. H. Garrell, A. M. Gibbs, and R. L. Miller.
New York Fish and Game Journal, Vol 25, No 1, p 79-82, 1978. 1 fig, 1 tab, 4 ref.

Descriptors: *Salmonids, *Rainbow trout, *Brown trout, *Brook trout, Fish stocking, *Trout, Fish establishment, Fish populations, *Eutrophication, *Hypolimnion, *Thermal stratification, *Aeration, *Oxygen requirements, Creel census, *New York, *Lake Waccabuc(NY).

A eutrophic lake was equipped with an aeration system and subsequently stocked with several salmonid species. An analysis of fish taken two years later demonstrated survival and successful growth in one of the salmonids (Rainbow trout). A resurgence in the numbers of white perch and yellow perch was also noted. It was concluded that aeration can maintain a cold-water fishery that would otherwise not survive in a eutrophic lake and can improve the environment for existing species. (Dael-EIS)
W78-06171

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

THE WELMM APPROACH TO ENERGY STRATEGIES AND OPTIONS,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
M. Grenon, and B. Lapillonne.
IIASA Report RR-76-19, December 1976. 43 p, 8 fig, 11 tab, 18 ref, 4 append.

Descriptors: *Energy strategies, *Energy resources, *Evaluation, Land, Manpower, Materials, Economics, Data storage and retrieval, Multiattribute analysis.

The development of energy resources requires more and more natural or human resources, on the one hand because of the difficulty of 'harvesting' primary energy resources, and on the other because of the complexity of the sequence of processes necessary to convert these primary resources into useful resources for an economy (final energy). In this context, the WELMM approach has been designed to evaluate the resource requirements for the development of energy resources. WELMM focuses mainly on five limited resources: Water, Energy, Land, Materials, and Manpower. The WELMM evaluation is implemented at the level of the major facilities concerned in the harvesting and conversion of primary energy resources into final resources. All the WELMM data are stored in three different data bases (Resource Data Bass, Component Data Base, and Facility Data Base). They are meant to be used to enlarge and complete the traditional economic comparison of energy processes, energy strategies or energy options. (Bell-Cornell)
W78-05704

SUPPLEMENTAL COLORADO RIVER WATER FOR A DEVELOPED GROUNDWATER AGRICULTURE: A PROBLEM OF QUANTITIES, QUALITIES AND CONJUNCTIVE USE,
Fish and Wildlife Service, Washington, DC. Office of Biological Services.
For primary bibliographic entry see Field 4B.
W78-05705

CAPACITY EXPANSION FOR WATER RESOURCE FACILITIES: A CONTROL THEORETIC ALGORITHM FOR NONSTATIONARY UNCERTAIN DEMANDS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6D.
W78-05706

AN EVALUATION OF ALTERNATIVE SLUDGE TECHNOLOGIES: A SURROGATE WORTH TRADEOFF APPROACH,
New Hampshire Univ., Durham. Inst. of Natural and Environmental Resources.
For primary bibliographic entry see Field 5E.
W78-05707

REGIONAL WATER SUPPLY PLANNING BY INTERACTIVE SYSTEMS ANALYSIS,
Army Engineer District, Sacramento, CA.
For primary bibliographic entry see Field 4A.
W78-05712

ECONOMIC ANALYSIS OF IRRIGATION PRODUCTION FUNCTIONS: AN APPLICATION OF LINEAR PROGRAMMING,
International Bank for Reconstruction and Development, Washington, DC. Development Research Center.
For primary bibliographic entry see Field 3F.
W78-05714

DECISION-MAKING IN THE DEVELOPMENT OF URBAN WATERFRONTS FOR PARK/BUSINESS USE,
Texas A and M Univ., College Station. Dept. of Recreation and Parks.
For primary bibliographic entry see Field 6B.
W78-05716

A MODEL CRITERION FOR SITE SELECTION OF LARGER SCALE TECHNICAL FACILITIES IN THE UPPER RHINE REGION,
Nuclear Research Center, Karlsruhe (West Germany).
For primary bibliographic entry see Field 5G.
W78-05720

A MATHEMATICAL MODEL FOR THE ANALYSIS OF MULTI-RESERVOIR FLOOD CONTROL SYSTEMS,
Natal Univ., Durban (South Africa).
For primary bibliographic entry see Field 4A.
W78-05721

DESIGN OF LARGE URBAN SEWER SYSTEMS WITH A WATER-FLOW SIMULATION PROGRAM,
Balzari Blaser Schudel, Bern (Switzerland).
For primary bibliographic entry see Field 5D.
W78-05722

OPTIMIZATION METHODS FOR PLANNING WASTE WATER MANAGEMENT SYSTEMS,
Karlsruhe Univ. (West Germany). Inst. fuer Siedlungswasserwirtschaft.
For primary bibliographic entry see Field 5G.
W78-05723

A STOCHASTIC MODEL OF LEVEE FAILURE,
Eotvos Lorand Univ., Budapest (Hungary). Dept. of Numerical Methods.
For primary bibliographic entry see Field 8D.
W78-05724

A WATER QUALITY OPTIMIZATION MODEL FOR NONSERIAL RIVER SYSTEMS,
Calgary Univ. (Alberta).
For primary bibliographic entry see Field 5B.
W78-05725

THE ANATOMY OF THE MODELLING PROCESS,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W78-05726

RANDOM SEARCH OPTIMIZATION: STOPPING RULES,
Aalborg Universitetscenter (Denmark).
For primary bibliographic entry see Field 2A.
W78-05727

SELECTING ALTERNATIVES IN WATER RESOURCES PLANNING AND THE POLITICS OF AGENDAS,
Johns Hopkins Univ., Baltimore, MD.
For primary bibliographic entry see Field 6B.
W78-05736

THE ROLE OF SYSTEMS ANALYSIS IN WATER PROGRAM DEVELOPMENT,
Harvard Univ., Cambridge, MA. Dept. of Engineering and Applied Mathematics.
M. B. Fiering.
In: Natural Resources Journal, Vol. 16, No. 4, p 759-771, October 1976. 1 fig, 9 ref. Symposium on Water Resources Management in a Changing World.

Descriptors: *Systems analysis, *Water management(Applied), *Water resources development, *Model studies, *Planning, Optimization, Conflict, Resource allocation, Computers, Decision-making, Mathematics, Water resources planning.

Systems analysis can play a fundamental role in water resource planning and design only if the analyst recognizes that optimality is elusive when applied to problems of conflict of interest, resource allocation, human value judgements, and stochastic processes. Important concepts treated in this essay are: (1) the ubiquitous occurrence of conflict, without which much more systems theory would be applicable to water resource planning; (2) robustness, that is, given the existence of conflict, it is desirable to seek solutions which may be non-optimal but significantly less brittle than the optimum; robustness is distinguished from system sensitivity in being a total rather than partial derivative; (3) stability, which is thought of as an important property of resource systems, leads to directing environmental standards and policies at maintaining ecological stability without regard to biological facts; and (4) resilience, contrasted with stability, which specifies designing for prospects not foreseen at the time of design, and to which no probability of occurrence can be assigned. Applications of systems analysis to water resource planning should stress the use of mathematical models to represent conflicts because well-defined objectives and constraints can rarely be found. With increased reliance on big, complex models, however, responsible use weighs heavily on the engineering profession. (Lynch-Wisconsin)
W78-05748

ECONOMIC AND ENVIRONMENTAL IMPACTS OF FOREST RESOURCE DEVELOPMENT,
Purdue Univ., Lafayette, IN.
H. W. Everett, II.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 592, Price codes: A07 in paper copy, A01 in microfiche. Master of Science Thesis, December, 1974. 125 p, 3 fig, 37 tab, 45 ref, 2 append. OWRT B-042-IND(5), 14-31-0001-3586.

Descriptors: Economic impact, Model studies, Economics, *Environmental effects, *Linear programming, Forest management, *Forest watersheds, Soil mechanics, Soil erosion, *Indiana, *Resource development, Discount rates, Mathematical studies, Lincoln Hills(IN), Environmental quality, Forest harvesting.

Direct economic and environmental impacts of a forest resource development project, Lincoln Hills region of Souther Indiana, were measured and their relationship illustrated; the indirect economic impact was measured at various levels of resource development. A linear programming model of the forest resource was developed to examine the effects of the resource development over a 50 year planning horizon, assessing alternative forest management practices, harvest methods, rates of harvest, and rates of discount upon economic output and soil losses. The sensitivity of the model was examined for changes in three harvesting programs used for establishing per period cuts of timber; for changes in the discount rate applied to net revenue coefficients; and for changes in level of soil loss. The allowable harvest program generates higher net revenue than the demand harvest program when soil losses are not or only slightly restrained. The method of harvest was also affected by the rate of harvest, so that as rates increased, either a select cutting and clear cutting combination or the latter along was more profitable than select cutting. Rate of discount changes reduced only net revenue figures. The model was also sensitive to changes in allowable soil loss level from the land, so that net revenue was reduced with reduced soil losses. Study of the indirect economic impact indicated that if the harvest could be further processed into secondary or final products in the region, a large increase in income, employment, and economic development could result. (Wares-IPA)
W78-05803

COST OPTIMIZATION OF RURAL WATER SYSTEMS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W78-05810

ESTIMATION OF BENEFITS AND ANALYSIS OF FACTORS INFLUENCING LAND USE CHANGE IN THE IOWA RIVER FLOOD PLAIN,
Iowa Univ., Iowa City. Dept. of Economics.
For primary bibliographic entry see Field 6B.
W78-05811

TECHNOLOGICAL FORECASTING APPLIED TO WATER RESOURCE PLANNING,
Iowa State Univ., Ames.
A. M. Behrens.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 564, Price codes: A05 in paper copy, A01 in microfiche. Master of Science Thesis, Industrial Engineering, 1975. 86 p, 14 fig, 2 tab, 103 ref, 2 append. OWRT A-057-IA(1).

Descriptors: *Technology, *Forecasting, *Water resources, *Planning, Methodology, Water demands, *Technological forecasting.

Types of technological forecasting methodologies and their usefulness to water resource planning are identified. Emphasis is on incorporating appropriate forecasting methodologies and

procedures into a forecasting and planning system which explicitly takes into account future technological development and goals affecting water resources. The three best methods for long-range forecasting were Delphi, analogy, and trend extrapolation, with Delphi and trend extrapolation favored for accuracy; Delphi was also favored to find turning points. Three forecasting activities were planned: exploratory, normative, and interactive feedback for adjustments needed to anticipate future demands for water and to allocate resources to develop sources to meet demands. Both present and possible new technology must be included in the forecast program. A forecasting system utilizing trend extrapolation, intution by knowledgeable persons in a Delphi process, and cross-impact simulation is proposed. Areas of needed future research are also described, including forecasting system refinement, applications and testing of the system, and operation of the system. (Wares-IPA)
W78-05813

CONCEPTS AND TECHNIQUES FOR EVALUATION OF ENERGY-RELATED WATER PROBLEMS,
Florida Univ., Gainesville. Center for Wetlands.
F. C. Wang, H. T. Odum, and M. E. Lehman.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 608, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, December 1977. 62 p, 14 fig, 5 tab, 31 ref, 2 append. OWRT C-7516 (6236)(1).

Descriptors: *Energy, *Planning, *System analysis, Water resources, *Water management(Applied), Computer simulation, Land-use planning, Linear programming, Water utilization, *Energy analysis, Energy quality, Energy value, Maximum power principle, Net productivity, Sensitivity analysis.

Research effort is described to apply the newly evolving theory of energy analysis and the classical operational research techniques (linear programming) to a procedure that may serve the resource manager in decision making. The theory investigated involves the concepts of net energy, energy quality, and energy amplifier value. Based on these concepts, an attempt was made to estimate energy values of water. One energy value of water is equal to the flow that it facilitates in a specific use. This is so because of its role as an amplifier which makes more energy available in different systems when used as a limiting factor. Another energy value is the embodied energy in forming water in processes of the biosphere or of man's activities. The energy effects may ultimately be related to embodied energy. The objective function in the linear programming analysis is structured in terms of net productivity of the subsystem measured at its boundary. The maximum power principle rather than profit maximization was used as a criterion because the system which gets the most energy and uses energy most effectively in competition with other systems will survive in the long run. Although the research effort should be further extended or modified to develop practical procedures for application, a simple hypothetical model considered representative of the major land-use subsystems is presented to illustrate such application. Sensitivity analysis was performed to test the stability of the model and its related problem solution to a resource plan.
W78-05940

INTEGRATING SCIENTIFIC DATA INTO ENVIRONMENTAL PLANNING AND IMPACT ANALYSIS, GENERAL METHODOLOGY AND A CASE STUDY,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 6G.
W78-06058

RESOURCES ALLOCATION TO OPTIMIZE MINING POLLUTION CONTROL,
Ohio State Univ. Research Foundation, Columbus.
For primary bibliographic entry see Field 5G.
W78-06138

6B. Evaluation Process

A WATER QUALITY PLANNING MODEL WITH MULTIPLE TIME, POLLUTANT, AND SOURCE CAPABILITIES,
Meta Systems Inc., Cambridge, MA.
For primary bibliographic entry see Field 5B.
W78-05702

MEASURING CONSUMER SURPLUS BENEFITS OF WATER SUPPLY EXTENSIONS IN DEVELOPING COUNTRIES,
Texas Univ. at Dallas, Richardson.
For primary bibliographic entry see Field 6D.
W78-05710

PLANNING METHODOLOGY FOR ANALYSIS AND MANAGEMENT ON LAKE EUTROPHICATION,
Yale Univ., New Haven, CT. School of Forestry and Environmental Studies.
For primary bibliographic entry see Field 5C.
W78-05715

DECISION-MAKING IN THE DEVELOPMENT OF URBAN WATERFRONTS FOR PARK/BUSINESS USE,
Texas A and M Univ., College Station. Dept. of Recreation and Parks.
J. W. Hanna, S. F. Philipp, and G. W. Mullins.
Water Resources Bulletin, Vol 14, No 1, p 179-189, February 1978. 1 fig, 5 tab, 18 ref.

Descriptors: *Urban renewal, *Decision making, *Planning, *Parks, *Waterfront development, Urban redevelopment, Riverfront development, Urban rivers, Implementation, Deterrents, Inventory, Data collections, Design, Houston(Tex), *Texas.

Opportunities for the development of an amalgam of park and leisure-oriented commercial establishments in urban-core waterfront settings exist in many United States cities. Public awareness of the need to enhance the environmental quality of these waterfront areas has resulted in a demand for planning and implementation action. However, the lack of understanding of urban political systems has been an inhibiting factor in the development of the park/business concept. Identified herein are the major factors that influence the decision-making process leading to the development of urban-core waterfronts for park/business use. Data collected has yielded information relating to three areas of urban-core waterfront development: inventory, decision-making process, and deterrent factors. Results show that deterrents to waterfront development include a lack of financial support for projects and proposals being prepared which are not suitable for application to the particular site. Understanding the necessary decision-making process can aid project implementation and avoid waste of planning effort in time, dollars, and productivity. (Bell-Cornell)
W78-05716

PROGRAMMER'S AND USER'S MANUAL FOR THE TRIBUTARY WATER QUALITY MODEL (FINAL REPORT ON PHASE 2),
Center for the Environment and Man, Inc., Hartford, CT.
For primary bibliographic entry see Field 5B.
W78-05717

THE RECREATIONAL RESPONSE TO CHANGES IN WATER QUALITY: A SURVEY AND CRITIQUE,
Leicester Univ. (England). Public Sector Economics Research Centre.
For primary bibliographic entry see Field 5G.
W78-05728

TOWARDS AN ECOLOGICALLY-BASED ECONOMIC PHILOSOPHY,
Oceanic Inst. Waimanalo, Hawaii.
J. A. Hanson.
Environmental Conservation, Vol 4, No 1, p 3-10, 1977. 4 fig, 17 ref.

Descriptors: *Economic theory, *Economic philosophy, *Natural resources, *Finite element analysis, *Energy, Economics, Industrial production, Conservation, Energy, Economics, Industrial production, Conservation, Energy conversion, Energy dissipation, Recycling, Urbanization, Water resources development, Regional economics, Negantrophy, Human population, Social values, Social change.

The present world economic order is one which fails to recognize the finiteness of global resources and limits of the global ecosystem to absorb wastes. As this order continues, the threshhold of economic energy recovery will reach a point where the amount of energy and materials needed to exploit the low grade energy resources will exceed the net energy produced these same resources. There are two alternatives to this problem: (1) an abrupt end of the present population level and material abundance; (2) a new global economic order based on recognition of the finiteness of this planet. Should the new economic order succeed its viability will depend on the complementarity of efficient energy conversion and conservation of negantropy (trend toward higher levels of organization). The extent to which the civilization can conserve its negantropy will determine the amount of energy available for the nonproductive activities related to a continuation of progress. The attainment of the new global economic order will require a move away from centralization and megagrowth of urban/industrial complexes towards a proliferation of moderate-size, semi-self-sufficient agri-industrial communities relying primarily on technolgy for wider communication. Such an approach would have following advantages: (1) conservation of transportation energy; (2) facilitation of recycling; (3) decreases in community management problems; (4) stimulation of geothermal, ocean-thermal, wind, and solar energy usages. (Harris-Wisconsin)
W78-05734

THE EFFECTS OF WATER RESOURCE DEVELOPMENT ON ECONOMIC GROWTH: THE CONDITIONS FOR SUCCESS,
Colorado Univ., Boulder. Dept. of Economics.
C. W. Howe.
In: Natural Resources Journal, Vol 16, No 4, p 939-955, October 1976. 1 tab, 21 ref. Symposium on Water Resources Management in a Changing World.

Descriptors: *Water resources development, *Water management(Applied), *Water supply, *Economic growth, Kenya, Mexico, Arizona, Middle East, Arkansas River, Uganda, Ghana, Africa, Developing countries.

Successful transfer of Western water development technology to the Third World depends on four conditions only rarely present: (1) that water is the real bottleneck to growth; (2) that capital is available; (3) that institutions exist which can manage the technology; and (4) that the technology fits the local social structure and values. Specific cases where water is a bottleneck are discussed, along with the relative importance of water to growth in various activities. Case studies are given for water development projects in Kenya, Mexico, Arizona,

the Middle East, the Arkansas River, Uganda, and Ghana. It is concluded that; (1) the relative importance of water services will change with growth; (2) water development has the most impact in early stages of growth due to the importance of agriculture; (3) provision of all requisite complementary inputs can result in high productivity and growth effects; (4) irrigation is a necessary but not sufficient condition for agricultural growth in arid and semiarid areas; (5) in mixed economics private sector investment response to public water project investment is a critical factor in determining total social returns; and (6) the availability of low-cost hydroelectric power is a strong attraction to the power-intensive metallurgical and chemical industries. (Lynch-Wisconsin)
W78-05735

SELECTING ALTERNATIVES IN WATER RESOURCES PLANNING AND THE POLITICS OF AGENDAS,
Johns Hopkins Univ., Baltimore, MD.
G. M. Wolman.
In: Natural Resources Journal, Vol 16, No 4, p 773-789, October 1976. 38 ref. Symposium on Water Resources Management in a Changing World.

Descriptors: *Alternative planning, *Decision-making, *Water resources planning, *Agenda, *Problem identification and ranking, Water management(Applied), Multiple-purpose projects, Conflict, Political constraint, Governments, Democracy, Planning.

The list of alternatives to be considered in water resources planning analagous to the political scientist's agenda of issues, is fundamental to the democratic process and access to it represents the politics of influencing or controlling the outcome of a decision. Examples taken from water resources planning demonstrate the relationship of agenda-building to democratic action, and indicate that multiplication of alternatives and participants can stymie decision-making. In moving toward more open democratic processes we are at present heavy on withholding approval at many levels and weak on decision-making mechanisms. While no simple rules exist for including or excluding alternatives from consideration, it is clear that selection of alternatives selection may not be an adequate guideline for future action. The kind of democracy that is evolved determines the rules for selection of agenda, of alternatives. Facts of geography involving local, regional, state, and national interests, as well as the pluralism of society, influence the choice of alternatives. Constraints on alternative planning include physical, and financial factors, illustrated by the examples presented. (Lynch-Wisconsin)
W78-05736

AMENITY AND EQUITY: A REVIEW OF LOCAL ENVIRONMENTAL PRESSURE GROUPS IN BRITAIN,
University Coll., London (England). School of Environmental Studies.
For primary bibliographic entry see Field 6E.
W78-05741

THE ROLE OF SYSTEMS ANALYSIS IN WATER PROGRAM DEVELOPMENT,
Harvard Univ., Cambridge, MA. Dept. of Engineering and Applied Mathematics.
For primary bibliographic entry see Field 6A.
W78-05748

A PUBLIC EDUCATION CAMPAIGN TO CONSERVE WATER,
Washington Suburban Sanitary Commission, Hyattsville, MD.
For primary bibliographic entry see Field 3D.
W78-05752

VERMONT'S WATER RESOURCE RESEARCH NEEDS,
Vermont Univ., Burlington. Dept. of Civil Engineering.
D. W. Stone.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 829, Price codes: A12 in paper copy, A01 in microfiche. Master of Science Thesis, February, 1976. 242 p, 2 fig, 34 tab, 33 ref, 7 append. OWRT A-021-VT(1).

Descriptors: *Vermont, *Water resources, *Research priorities, *Water quality, *Planning, *Management, Water requirements, Water pollution, Lakes, Reservoirs.

A three-fold approach provided a complete analysis of Vermont's water resource research needs. Research information was obtained from responses to a general topical questionnaire, developed from research needs identified by 62 individuals knowledgeable on the State's problems. In addition, the questionnaire was sent to members of four important Vermont organizations (engineering, recreation, planning, and resource societies). Topics found to be of high importance were discussed and elaborated in a round table discussion. Generally, research on ground water quality protection, lake and reservoir quality degradation, non-point source pollution, and municipal waste water systems was considered most significant. The Lake Champlain Basin, the Connecticut River Basin, the Lake Memphremagog Basin, and the Hudson River Basin were ranked as highly important to Vermont. Flowing rivers/streams, lakes/ponds, and ground water were also important to respondenst; little overall concern was shown for wetlands. Water quality management research, planning management, and sociological research, and water quantity management research were also ranked. The consensus indicated the value of this strategy in identifying research needs; it was inferred that this method may be applied in identifying similar needs in other areas of the U.S. (Wares-IPA)
W78-05801

WATER USE RATES FOR RURAL WATER SYSTEMS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
R. S. Schulz.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 618, Price codes: A08 in paper copy, A01 in microfiche. Master of Sciences Thesis, 1975. 148 p, 59 fig, 15 tab, 32 ref, 1 append. OWRT A-048-IA(4).

Descriptors: *Water utilization, *Rural areas, *Livestock, Water requirements, Iowa, Peak discharge, Water distribution(Applied), Storage requirements, Kansas, *Water demand, *Water use rates, *Nomographs.

Rural water system use rates in Iowa were computed to predict livestock needs and ascertain rural domestic use patterns. Nomographs predicted livestock water use based on animal weight and environmental temperature; average gallons/capita/day value contributing to the domestic water requirements were determined. General trends in the daily occurrence of peak flows were established. Uniform water use indicated the distribution patterns ascertained in line test sections were representative of patterns for all consumers. Use rates data showed that Iowa rural water is not being used in quantities predicted by design criteria; differences are attributed to the effect of metered water, the associated cost of metered water, and farmers' reluctance to abandon the farm wells. Peak use periods were spread out over a longer span than is normally seen in high density residential areas, probably because of livestock feeding operations. Higher peaking factors were observed in the testing than those used for design of water systems meeting residential, industrial, and commercial water requirements. Comparison of data obtained with simultaneous peak demand curves used for the design of other systems showed that recorded peak rates fell short of values read from Kansas data. Nomographs indicating livestock water consumption developed from data in the literature are higher than water requirements based on animal weight and average environmental temperature; they are recommended, therefore, for use for the ranges indicated, with special consideration for simultaneous peak demands and storage requirements. (Wares-IPA)
W78-05809

ESTIMATION OF BENEFITS AND ANALYSIS OF FACTORS INFLUENCING LAND USE CHANGE IN THE IOWA RIVER FLOOD PLAIN,
Iowa Univ., Iowa City. Dept. of Economics.
D. B. Oyen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 559, Price codes: A09 in paper copy, A01 in microfiche. PhD Thesis, July, 1973. 173 p, 3 fig, 10 tab, 89 ref, 2 append. OWRT A-0380-IA(3), 14-31-0001-3215.

Descriptors: *Land use, *Flood plain, Dams, *Iowa, Farms, *Regression analysis, *Mathematical studies, Farm prices, Cost-benefit analysis, Model studies, *Coralville Dam(IA), *Iowa River(IA), *Pareto optimum, Net benefits, Land value.

The extent of land use change in the Iowa River flood plain following the 1958 installation of the Coralville Dam is investigated; benefits accruing from and economic factors accounting for these changes are analyzed. The claiming of benefits from land use change is justified via an extension of the Pareto optimum conditions. Approximately 938 acres of flood plain land have been brought into agricultural production. Using historical prices, the present value of estimate benefits from land use change is $235,712 when discounting at 3.25%, and $189,958, discounting at 7%. Using estimated free market prices, the present values are $110,772 and $93,531, when discounting at 3.25% and 7% respectively. Based on a theoretical model of flood plain land usage and data compiled in previous land use change studies, it was revealed that farmers who made land use changes: (1) had smaller crop acreages, (2) were older an better educated, (3) had smaller percent of their incomes derived from farm operations, and (4) had higher incomes than farmers who made no change. Farmers who brought land into production tended to live closer to the Dam, realized higher yields on corn and beans, and had more land available for conversion. A regression model was used to account for the simultaneous influences of variables; results indicate that the probability of land use change increases with increases in the number of acres available for conversion, the landowner's age, and number of years of education. Probability of land use change decreases as distance from the Dam increases and the number of crop acres increases. (Seip-IPA)
W78-05811

TECHNOLOGICAL FORECASTING APPLIED TO WATER RESOURCE PLANNING,
Iowa State Univ., Ames.
For primary bibliographic entry see Field 6A.
W78-05813

REVIEW OF THE FLINT CREEK SMALL WATERSHED PROJECT, DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE ONTARIO COUNTY ENVIRONMENTAL MANAGEMENT COUNCIL,
Cornell Univ., Ithaca, NY. Center for Environmental Research.
For primary bibliographic entry see Field 6G.
W78-05814

CONCEPTS AND TECHNIQUES FOR EVALUATION OF ENERGY-RELATED WATER PROBLEMS,
Florida Univ., Gainesville. Center for Wetlands.
For primary bibliographic entry see Field 6A.
W78-05940

ENVIRONMENT, TECHNOLOGY, AND FUTURE GENERATIONS,
Oregon State Univ., Corvallis. Water Resources Research Inst.
D. A. Bella.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 605, Price codes: A03 in paper copy, A01 in microfiche. Completion Report WRRI-57, January 1978. 36 p, 1 fig, 45 ref. OWRT C-5195 (4209)(2).

Descriptors: Environmental techniques, *Attitudes, *Social values, Costs, Benefits, *Technology, *Environment, Environmental effects, *Social change, *Future planning(Projected).

Environmental strategies involve comprehensive and broad outlooks. In contrast, environmental tactics involve more limited concerns which can be usually addressed in a disciplinary or multidisciplinary manner. The development of strategies necessitates interdisciplinary and transdisciplinary outlooks. Such outlooks are extremely difficult to achieve because different 'structures of reasoning' are found to conflict with each other and confusion and disagreements result. Environmental strategies must accommodate such confusions. They must recognize and accommodate the high levels of ignorance involved in the prediction and appreciation of complex and long-term technological impacts. A strategy is proposed which encourages an adjusting, learning and creative approach to the future rather than an approach which is ultimately based upon prediction and control. The approach is described through a set of five commitments which are intended, not as absolute rules, but as attitudes or considerations which should have increased influence upon decisions. A number of applications and examples are briefly discussed.
W78-05941

PROCEEDINGS OF THE ELEVENTH BIENNIAL CONFERENCE ON GROUND WATER.
California Univ., Davis. Water Resources Center; and California State Dept. of Water Resources. Sacramento.
For primary bibliographic entry see Field 4B.
W78-06039

DIRECTORY OF WATER RESOURCES EXPERTISE, WATER RESEARCH FACULTY AND STAFF SCIENTISTS.
California Univ., Davis. Water Resources Center.
For primary bibliographic entry see Field 9A.
W78-06041

INTEGRATING SCIENTIFIC DATA INTO ENVIRONMENTAL PLANNING AND IMPACT ANALYSIS, GENERAL METHODOLOGY AND A CASE STUDY,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
For primary bibliographic entry see Field 6G.
W78-06058

OFF-PEAK HOUR PUMPING RATE REDUCTION: ARE THE BENEFITS WORTH THE COSTS,
Boyle Engineering Corporation, Ventura, CA.
R. J. Mauck.
Water and Wastes Engineering, Vol 14, No 9, September 1977, p 70-72. 4 fig, 2 tab.

Descriptors: *Cost-benefit analysis, *Pumping plants, *Off-peak hour pumping rate reductions, *Water supply, *Water management(Applied), Costs, Antelope Valley-East Kern Water Agency(CA), California, Waste storage, Pricing, Electric power costs, Economic analysis, Water demand, Treatment facilities, Water treatment, Sanitary engineering.

Analysis of four off-peak hour pumping rate reduction alternatives shows there is a point at which construction costs for facilities to increase the capacity for off-peak pumping exceeds savings in annual power costs. The study was commissioned by the Antelope Valley-East Kern Water Agency, California. As the local power company charges lower rates for off-peak hours, lower power costs could be realized through use of an off-peak demand adjustment. Conclusions were: (1) A large on-peak power usage rate must occur before a 'total off-peak' pumping system becomes competitive; in such a system the entire treatment plant flow is pumped in the 8-hr off-peak period, requiring an expansion of facilities greater than for the other systems. (2) The 'variable speed' system is sensitive to power rate increases; in this system pumps operate 24 hrs/day, but match flow output of the treatment plant. (3) The 'on-off-peak' system has lower present worth power costs, while the 'constant' system has lower construction capital costs; the former limits flow pumped in the off-peak period to maximum peak flow capacity of the treatment plant, and requires a minimum flow during the on-peak period. The 'constant' system employs pumps with constant speed drives, and pumps cycle to on when working storage capacity is reached (≈ one hr peak flow) and cycle to off when storage is emptied. (Lynch-Wisconsin)
W78-06134

STRICTER CONSERVATION SOUGHT AS PART OF ANY WATER RESOURCE POLICY,
C. W. Heckroth.
Water and Wastes Engineering, Vol 14, No 9, September 1977, p 48-50.

Descriptors: *Water policy, Water resources, *Water supply, *Water conservation, *Water management(Applied), Governments, Social participation, Attitudes, Pricing, Water rates, Incentives, Recycling, Economics, Groundwater, Water utilization, *Planning, Water demand.

A federal issue paper on water conservation is summarized, and options for consideration for each of five primary problems are discussed. The issue paper was published in the July 15, 1977 Federal Register with three others--planning and evaluation criteria, cost-sharing, and institutions--as part of a comprehensive review of federal water resources policy being conducted by the Carter administration to lead to establishment of a national resources management policy. Hearings were scheduled in eight U.S. cities to obtain public participation and viewpoints. The problems analyzed in this article are: (1) The price of water is insufficient to provide the incentives necessary to promote efficiency and prevent wasteful uses. (2) Inadequate consideration has been given to meeting existing water needs by means of comprehensive watershed management practices, including storage and transfer of surplus water derived from existing supplies. (3) Limited reuse and recycling of water reduces the quantity and quality of water available for all offstream uses and instream values. (4) Groundwater supplies are poorly regulated and are being seriously depleted in some areas through excessive withdrawals. (5) Large quantities of water are wasted in existing water-consuming facilities and production processes where a significant change in the process could greatly reduce the need for water. (Lynch-Wisconsin)
W78-06136

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

PRICE VARIABLE IN RESIDENTIAL WATER DEMAND MODELS,
Oregon State Univ., Corvallis. Dept. of Resource Recreation Management.
For primary bibliographic entry see Field 6D.
W78-05703

POLICY OF PRICING IRRIGATION WATER,
Ministry of Agriculture and Irrigation, New Delhi (India).
For primary bibliographic entry see Field 3F.
W78-05730

RATIONALISATION OF IRRIGATION RATES IN A DEVELOPING COUNTRY,
Central Water Commission, New Delhi (India).
For primary bibliographic entry see Field 3F.
W78-05731

ARE NATURAL RESOURCES CAPITAL USING A MICROANALYTIC APPROACH,
Tulane Univ., New Orleans, LA.
J. R. Moroney.
Southern Economic Journal, Vol. 43, No. 3, p 1203-1217, January 1977. 3 tab, 30 ref. NSF HES 75-20778.

Descriptors: *Natural resources, *Capital use, *Industrial production, *Economics, Industries, Model studies, Labor, Capital-labor ratios, Costs, Wages.

A microanalytic framework is given for testing the hypothesis that natural resource requirements tend to be capital-using across industries, and the resulting statistical models are applied to a sample of 104 American manufacturing industries. Application of these models, each based on different assumptions concerning capital-labor substitution, suggests four conclusions: (1) The most restrictive model indicates resources tend to be capital-using. The evidence is weaker if allowance is made for intergroup differences in intercept terms, and the capital-using hypothesis is not sustained with more general models incorporating factor substitution. (2) With the model incorporating the most general approach, resources appear to exert a capital-using bias in three resource-intensive sectors, but seem to be neutral or labor-using in all others. (3) Although some resource-intensive sectors (e.g., petroleum, chemicals primary metals) have high average capital-labor ratios, this is due more to high wage rates than to intensive natural resource requirements. Other industries processing intermediate inputs of equal or greater resource intensity (e.g., tobacco, certain foodstuffs) have low capital-labor ratios correspondingly attributable to low wage rates. (4) These findings indicate that certain resources may be intrinsically suited to capital-intensive development methods, and that the capital-using thesis is not a substantive cause for the factor content of American trade. (Lynch-Wisconsin)
W78-05732

THE ENVIRONMENTAL COSTS OF LANDFILLS AND INCINERATORS,
Chicago Univ., IL. Center for Urban Studies.
For primary bibliographic entry see Field 5E.
W78-05738

WATER USE RATES FOR RURAL WATER SYSTEMS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W78-05809

COST-EFFECTIVENESS OF ON-SITE AND COMMUNITY SEWERAGE ALTERNATIVES,
Brown and Caldwell, Eugene, OR.
For primary bibliographic entry see Field 5D.
W78-05910

6D. Water Demand

PRICE VARIABLE IN RESIDENTIAL WATER DEMAND MODELS,
Oregon State Univ., Corvallis. Dept. of Resource Recreation Management.
K. C. Gibbs.
Water Resources Research, Vol 14, No 1, p 15-18, February 1978. 2 tab, 9 ref.

Descriptors: *Water demand, *Mathematical models, *Marginal price, *Residential water, Miami(Fla), Equations, Estimating, Systems analysis.

There have been inconsistencies in past residential water demand studies concerning the specification of the relevant price variable. Both average and marginal price have been used. Households faced with the decision to expand (or contract) their water consumption are responsive to the additional cost (or savings) involved with this decision. The appropriate measure of this price is marginal price, not average price. Data were gathered from a large metropolitan area--Miami, Florida--to illustrate the divergence in estimation from two demand models, identically specified, except for the price variable. One utilized marginal price and the other used average price. Predictions of consumption varied from 22 to 107% between the two models. The average price model significantly overestimated the response of consumption to price and income changes, a result worthy of consideration. (Bell-Cornell)
W78-05703

CAPACITY EXPANSION FOR WATER RESOURCE FACILITIES: A CONTROL THEORETIC ALGORITHM FOR NONSTATIONARY UNCERTAIN DEMANDS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
D. Grossman, and D. H. Marks.
Advances in Water Resources, Vol 1, No 1, p 31-40, September 1977. 8 fig, 9 ref.

Descriptors: *Water resources development, *Capacity expansion, *Alternative planning, *Dynamic programming, Stochastic processes, *Algorithms, Demand, Cost minimization, Optimization, Water shortage, Mathematical models, Equations, Systems analysis, Risks, *Water demand.

Municipal water and waste water investments represent a large and important segment of the expenditures made by local governments. The response of designers to the problem of sizing increments to capacity has been to overbuild in order to assure safe and adequate supplies. A growing body of evidence suggests that the magnitude of overbuilding has been excessive. Earlier research has neglected to model demand growth as uncertain with the possibility of both nonstationary mean and variance. Also, failure to recognize the problem as one of closed loop control has resulted in erroneous modeling efforts. This research presents the use of stochastic dynamic programming to model the optimal capacity expansion of water resources facilities, where the objective function is to minimize the expected cost. Excess capacity--the state of the system--increases due to investment decisions. Negative excess capacity implies shortage. As time progresses, known but possibly uncertain demands impinge upon the system. In conclusion, several highly flexible capacity planning models for nonstationary demands can be formulated which are computationally feasible and produce excellent approximations to known solutions. However, these models should be used only after sensitivity testing in conjunction with simpler approaches. (Bell-Cornell)
W78-05706

MEASURING CONSUMER SURPLUS BENEFITS OF WATER SUPPLY EXTENSIONS IN DEVELOPING COUNTRIES,
Texas Univ. at Dallas, Richardson.
M. T. Katzman.
Water Resources Bulletin, Vol 14, No 1, p 46-54, February 1978. 1 fig, 3 tab, 15 ref.

Descriptors: *Water supply, *Cost-benefit analysis, *Investment, *Demand curve technique, Developing countries, Projects, Linear model, Regression analysis, Water mains, Capitalization, Estimating, Penang Island(Malaysia), Consumer surplus benefits, Methodology, Systems analysis.

For investments in water mains serving new households, consumer surplus benefits may far outweigh those measured by revenues recoupled from user fees. While consumer surplus might be capitalized in the value of sites with access to mains, empirical attempts to measure such capitalization have not proved invariably successful. An alternative technique based upon the direct estimation of the demand curve is utilized. An analysis of Penang Island, Malaysia indicates that the consumer surplus benefits are one and one-half times greater than the revenues recoupled though user fees. The applicability of this technique to cost-benefit analysis of water supply investments is discussed. In conclusion, the estimation of consumer surplus by tracing the demand curve is feasible for systems which have accurate metering and billing procedures and which have exhibited substantial variation in water charges over time and space. For systems meeting these conditions, the calculation of the net benefits of water supply extensions by the demand curve technique is simpler than by the method of land capitalization; the demand curve technique is less general in that it applies only to priced services and it is less likely to measure the external benefits. (Bell-Cornell)
W78-05710

POLICY OF PRICING IRRIGATION WATER,
Ministry of Agriculture and Irrigation, New Delhi (India).
For primary bibliographic entry see Field 3F.
W78-05730

A PUBLIC EDUCATION CAMPAIGN TO CONSERVE WATER,
Washington Suburban Sanitary Commission, Hyattsville, MD.
For primary bibliographic entry see Field 3D.
W78-05752

TECHNOLOGICAL FORECASTING APPLIED TO WATER RESOURCE PLANNING,
Iowa State Univ., Ames.
For primary bibliographic entry see Field 6A.
W78-05813

STRICTER CONSERVATION SOUGHT AS PART OF ANY WATER RESOURCE POLICY,
For primary bibliographic entry see Field 6B.
W78-06136

WATER RESOURCES INVENTORY OF NORTHWEST FLORIDA,
Geological Survey, Tallahassee, FL. Water Resources Div.
J. E. Dysart, C. A. Pascale, and H. Trapp, Jr.
Water-Resources Investigations 77-84, November 1977. 114 p, 10 fig, 9 tab, 49 ref.

Descriptors: *Water resources, *Surveys, *Surface waters, *Groundwater resources, *Florida, Water quality, Available water, Projections, Water supply, Water demand, Rainfall-runoff relationships, Flood plains, Gulf Coastal Plain, Streamflow, Flow rates, Aquifer characteristics, Water wells, Water yield, Drawdown, Water level fluctuations, Groundwater recharge, Northwest Florida, Florida panhandle.

Water resources of the 16 counties of the northwest Florida appear adequate until at least 2020. In the 4 westernmost counties, the sand-and-gravel aquifer and streams combined could provide 2,200 to 3,600 million gallons per day of water. Streams outside these counties could provide 5,600 million gallons per day. The Floridan aquifer could provide 220 million gallons per day. Generally, water of quality suitable for most purposes is available throughout the area, although water in smaller streams and in the sand-and-gravel aquifer is acidic and locally contains excessive iron. Water in the upper part of the Floridan aquifer is generally fresh, but saline at depth and in some coastal areas. The quantity of water available in the study area is about 8,020 to 9,420 million gallons per day and projected needs for the year 2020 range from 2,520 to 4,130 million gallons per day. 'Approximate method' flood-prone area maps cover most of the area. (Woodard-USGS)
W78-06183

6E. Water Law and Institutions

RATIONALISATION OF IRRIGATION RATES IN A DEVELOPING COUNTRY,
Central Water Commission, New Delhi (India).
For primary bibliographic entry see Field 3F.
W78-05731

THE EFFECTS OF WATER RESOURCE DEVELOPMENT ON ECONOMIC GROWTH: THE CONDITIONS FOR SUCCESS,
Colorado Univ., Boulder. Dept. of Economics.
For primary bibliographic entry see Field 6B.
W78-05735

AMENITY AND EQUITY: A REVIEW OF LOCAL ENVIRONMENTAL PRESSURE GROUPS IN BRITAIN,
University Coll., London (England). School of Environmental Studies.
P. D. Lowe.
Environmental Planning A, Vol. 9, No. 1, p 35-58, January 1977. 1 fig, 85 ref.

Descriptors: *Great Britain, *Political aspects, *Pressure groups, *Social aspects, *Environmental control, *Decision-making, Amenity societies, Interest groups, Social change, Social participation, Urban sociology, Social needs, Legislation, Planning, Aesthetics, Community development, Administration, City planning, Public access, Organization, Economic impact, Pollution abatement, Social impact.

Activities of local environmental pressure groups in Britain could have major spatial and social distributional consequences; but participation may serve to exacerbate certain inequalities, and persons whose interests are least represented by the existing social and spatial structure are likely to fare worst politically. The basic question is not whether amenity societies contribute to good planning, but rather what the relationship is between statutory planning and various powerful sectional interests. Local environmental pressure groups, which are geographically-defined, comprise the amenity, civic, and preservation societies, residents' and tenants' associations, and community action groups. They seek to influence public decision-making and to protect the material, but nonproductive, interests of their number. They are concerned with protecting and enhancing the

environment, the amenity and accessibility of a street, development, town, suburb, or county. Amenity includes safety, freedom from pollution, local interest, peace and quiet, and aesthetics, while accessibility covers convenience of schools, shops, clinics, open space, recreation, transportation, and employment. Six aspects of such groups include: (1) their origins and evolution, (2) ethic and ideology, (3) political equity, (4) representativeness, (5) variations in political efficacy, and (6) failure of some groups to achieve effective political expression. (Lynch-Wisconsin)
W78-05741

INTERNATIONAL CO-OPERATION AND INLAND WATERS: THE INFLUENCE OF FEDERALISM,
United Nations Secretariat.
D. Alheritiere.
In: Natural Resources Journal, Vol. 16, No. 4, p 903-921, October 1976. 97 ref. Symposium on Water Resources Management in a Changing World.

Descriptors: *International waters, *Inland waterways, *Federalism, *Treaties, *Governments, International cooperation, Canada, United States, Conflict, International law, Riparian rights.

A review of international agreements shows that, in general, federalism favors rather than hinders international cooperation in terms of inland waterways. This essay analyzes both positive and negative aspects of federalism, and cites many examples of each. By federalism is meant a form of government in which internal pluralism is compromised with external uniformity; over one-third of the world population lives under federal regimes. Due to the involvement of member states in federal decision-making, the process of international agreement is often slowed. Interstate experience has shown that detailed legal rules may not be needed to frame and guide the cooperative process, although strong, broad legal principles are necessary as a reference. Governments often prefer loose, informal agreements to formal legal frameworks; the technique of using joint technical boards rather than permanent political interstate agencies has proved attractive, as indicated by agreements between Canada and the United States. As each water body is an individual case, a pragmatic approach should be followed, including, for example, special river commissions instead of a general law of rivers. Interstate law is helpful in international cooperation since it demonstrates the necessity of developing original solutions for each conflict. (Lynch-Wisconsin)
W78-05746

WATER FOR THE WEALTHY,
For primary bibliographic entry see Field 5G.
W78-05750

CHALLENGING EFFLUENT LIMITATIONS,
Morgan, Lewis and Bockius, Washington, DC.
For primary bibliographic entry see Field 5G.
W78-05759

JAMESPORT TRANSMISSION EXITS; A REVIEW FOR THE TOWN OF RIVERHEAD OF THE LONG ISLAND LIGHTING COMPANY APPLICATION TO THE NEW YORK PUBLIC SERVICE COMMISSION FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED FOR THE JAMESPORT TRANSMISSION EXITS,
Cornell Univ., Ithaca, NY. Center for Environmental Research.
For primary bibliographic entry see Field 6G.
W78-05816

ALASKA SHELLFISH REGULATIONS: PRESENT IMPACTS ON FISHERY PARTICIPANTS,
Illinois Univ. at Chicago Circle. Dept. of Information Engineering.
P. L. Katz, and L. J. Bledsoe.
Transactions of the American Fisheries Society, Vol. 106, No. 6, November 1977, p 505-529, 6 fig, 2 tab, 31 ref. NOAA 04-5-158-48 and 03-6-208-70.

Descriptors: *Fisheries, *Fish management, Alaska, *Shellfish regulations, Catch allocation, Season openings(Fishing).

Considered is one aspect of the present Alaska Shellfish Regulations: the effective creation of advantages and disadvantages to various types of shellfish fishery participants. The existence of many other important effects of these regulations such as conserving the stocks, accurate reporting of catch and maintaining orderly fisheries is recognized. It is suggested that effective shellfish catch allocation results from exclusive area regulation; pot limits and presoak regulations; seasonal catch allocations and gear restrictions for shrimp; scheduling of season openings; and king crab regulation for multiple year classes. The paper considers some possibilities for regulating incidental catch of halibut and crab, taken by a potential U. S. ground-fish trawl fishery in the region. (Chilton-ORNL)
W78-05955

HEAVY HANDS ON THE POLLUTION CONTROLS,
Harvard Univ., Boston, MA. Graduate School of Business Administration.
For primary bibliographic entry see Field 5G.
W78-06031

PROCEEDINGS OF THE ELEVENTH BIENNIAL CONFERENCE ON GROUND WATER.
California Univ., Davis. Water Resources Center; and California State Dept. of Water Resources. Sacramento.
For primary bibliographic entry see Field 4B.
W78-06039

FEDERAL LAKE ERIE WATER QUALITY STANDARDS PROPOSALS.
Environmental Protection Agency, Region V, Chicago, IL.
For primary bibliographic entry see Field 5G.
W78-06048

INLAND WETLAND DEFINITIONS,
Connecticut Univ., Storrs. Biological Sciences Groups.
For primary bibliographic entry see Field 2H.
W78-06083

A GUIDE TO UNDERSTANDING AND ADMINISTRATING THE MASSACHUSETTS WETLANDS PROTECTION ACT.
Massachusetts Audubon Society, Lincoln.
1977. 270 p.

Descriptors: *Massachusetts, *Wetlands, *Legislation, *Water resources development, Administration, Administrative agencies, Legal aspects, Project planning, Regulation, Permits, Water law, Marsh management, *Massachusetts Wetland Protection Act.

This guide is designed to aid local officials think through the wetland protection process as established by the Wetlands Protection Act and its regultions. Chapters are organized according to the step-by-step procedures required of conservation commissions, applicants, the Massachusetts Department of Environmental Quality Engineering, and other interested citizens. It starts with establishing the commission's jurisdiction and ending with the final order of conditions. Explanations of the law and regulations are provided to clarify what areas and acts are covered and the responsibilities of the enforcing agencies. While designed for the Massachusetts legislation, the full discussion of functions and values of wetlands and the legal basis for wetland protection and regulatory processes make it a basic reference with application beyond this single state. (Steiner-Mass)
W78-06084

STRICTER CONSERVATION SOUGHT AS PART OF ANY WATER RESOURCE POLICY,
For primary bibliographic entry see Field 6B.
W78-06136

6F. Nonstructural Alternatives

FLOOD PLAIN INFORMATION: MONONGAHELA, WEST FORK AND TYGART RIVERS, MARION COUNTY, WEST VIRGINIA.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 4A.
W78-05761

FLOOD PLAIN INFORMATION: WEST FORK RIVER AND ELK CREEK, CLARKSBURG AND VICINITY, HARRISON COUNTY, WEST VIRGINIA.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 4A.
W78-05762

FLOOD PLAIN INFORMATION: LITTLE WHEELING CREEK, TRIADELPHIA TO VALLEY GROVE, OHIO COUNTY, WEST VIRGINIA.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 4A.
W78-05763

FLOOD PLAIN INFORMATION: FULTON BRANCH, WEBSTER CREEK AND TRIBUTARIES, WAMAC, ILLINOIS.
Army Engineer District, St. Louis, MO.
For primary bibliographic entry see Field 4A.
W78-05764

FLOOD PLAIN INFORMATION: SILVER CREEK AND TRIBUTARIES, ST. CLAIR COUNTY, ILLINOIS - NO. 1.
Army Engineer District, St. Louis, MO.
Prepared for County of St. Clair, IL, September 1974, 32 p, 10 fig, 41 plates, 4 tab.

Descriptors: *Illinois, *Streamflow forecasting, *Flood profiles, *Flood data, Floods, Flood flow, Storms, Historic floods, Flood stages, Peak discharge, Stage-discharge relations, Flood plains, Standard Project Flood, Flood protection, Flood plain insurance, Warning systems, Land use, Planning, Zoning, Control structures, St. Clair County(IL), *Silver Creek(IL), Little Silver Creek(IL), Loop Creek(IL), Ogles Creek(IL), Intermediate Regional Flood.

The study area covers a distance of approximately 28.4 miles and involves the portions of St. Clair County, Illinois that are subject to flooding from Silver Creek and its tributaries, Little Silver, Loop, and Ogles Creek. The flood plains are mostly agricultural, although commercial and residential land uses are encroaching on the open flood plain lands. Flood data were obtained from topographic maps, field studies, historical sources, and stream gage records. The main flood season occurs from April through June and results from thunderstorms preceded by long periods of ground saturating rainfall. The worst known flood recorded at the downstream limit of the study area occurred in August, 1946, cresting at approximate-

ly 414 feet mean sea level (msl). At the same location, the Intermediate Regional Flood would crest at 407.6 feet msl, and would discharge 32,100 cubic feet per second (cfs), while the Standard Project Flood would crest at 411.3 feet msl and would discharge 50,000 cfs. Numerous bridges would obstruct these flood flows. This study is intended for use in making land use planning and management decisions concerning flood plain utilization. (Nessa-NC).
W78-05765

ESTIMATION OF BENEFITS AND ANALYSIS OF FACTORS INFLUENCING LAND USE CHANGE IN THE IOWA RIVER FLOOD PLAIN,
Iowa Univ., Iowa City. Dept. of Economics.
For primary bibliographic entry see Field 6B.
W78-05811

HEAVY HANDS ON THE POLLUTION CONTROLS,
Harvard Univ., Boston, MA. Graduate School of Business Administration.
For primary bibliographic entry see Field 5G.
W78-06031

A TECHNIQUE FOR DETERMINING DEPTHS FOR T-YEAR DISCHARGES IN RIGID-BOUNDARY CHANNELS,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 4A.
W78-06189

6G. Ecologic Impact Of Water Development

A MODEL CRITERION FOR SITE SELECTION OF LARGER SCALE TECHNICAL FACILITIES IN THE UPPER RHINE REGION,
Nuclear Research Center, Karlsruhe (West Germany).
For primary bibliographic entry see Field 5G.
W78-05720

TOWARDS AN ECOLOGICALLY-BASED ECONOMIC PHILOSOPHY,
Oceanic Inst. Waimanalo, Hawaii.
For primary bibliographic entry see Field 6B.
W78-05734

THE ENVIRONMENTAL COSTS OF LANDFILLS AND INCINERATORS,
Chicago Univ., IL. Center for Urban Studies.
For primary bibliographic entry see Field 5E.
W78-05738

AMENITY AND EQUITY: A REVIEW OF LOCAL ENVIRONMENTAL PRESSURE GROUPS IN BRITAIN,
University Coll., London (England). School of Environmental Studies.
For primary bibliographic entry see Field 6E.
W78-05741

ENVIRONMENTAL PROTECTION GUIDELINES FOR CONSTRUCTING PROJECTS,
East Bay Municipal Utility District, Oakland, CA.
W. F. Anton, and J. L. Bunnell.
Journal of American Water Works Association, Vol. 68, No. 12, p 643-646, December 1976.

Descriptors: *Environmental control, *Construction, *Water pollution control, *Erosion, *Runoff, Air pollution, Drainage, Oakland(CA), California, Waste disposal, Vegetation establishment.

Guidelines for minimizing the environmental impact of construction projects were issued by the East Bay Municipal Utility District (EBMUD) of Oakland, California for use by inspectors and design engineers. The guidelines cover: (1) noise abatement, (2) traffic controls and detours, (3) elimination of safety hazards, (4) protection of vegetation, (5) runoff and erosion controls, (6) dust control, (7) air quality control, (8) visual/aesthetic enhancement, (9) limitations on service interruptions, (10) historical and archaeological protection, (11) paving repair, (12) construction wastes disposal, and (13) completion of the project. For runoff and erosion control reseeding, fertilizing, and mulching (where specified) are recommended to ensure recovery of grass cover; on steep slopes hemp mesh or other approved methods of mulching, seeding, and fertilizing should be used to minimize erosion until natural ground cover is established. Temporary drainage channels and structures should be provided to minimize erosion and prevent pond formation, and water used in washing down construction areas or flushing pipelines must be diverted into storm sewers or natural channels. Detention ponds, silt dams, and settling basin should be used to lessen soil erosion and sedimentation. Solid wastes generated by the project should be recycled or reused where possible, or disposed of properly. (Lynch-Wisconsin)
W78-05742

ECONOMIC AND ENVIRONMENTAL IMPACTS OF FOREST RESOURCE DEVELOPMENT,
Purdue Univ., Lafayette, IN.
For primary bibliographic entry see Field 6A.
W78-05803

REVIEW OF THE FLINT CREEK SMALL WATERSHED PROJECT, DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE ONTARIO COUNTY ENVIRONMENTAL MANAGEMENT COUNCIL,
Cornell Univ., Ithaca, NY. Center for Environmental Research.
J. Bart, E. Duvernoy, and J. Stanturf.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 762, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, November, 1975. 71 p, 1 fig, 1 tab, 4 ref, 8 append. OWRT A-056-NY(1).

Descriptors: *Reviews, Documentation, *New York, *Environmental effects, *Watershed management, Cultivated lands, Flood control, Evaluation, Land management, Land subsidence, Erosion, Sheet erosion, Erosion rates, Soil erosion, Sediments, Wind erosion, Estimated benefits, *Environmental Impact Statement, *Flint Creek(NY), Ontario County(NY), Guidelines, Flood prevention.

A review of the 'Flint Creek Watershed Environmental Impact Statement' was carried out using the EIS guidelines supplied by the DOA's Soil Conservation Service as the principal evaluation criterion. Conclusions of the agency regarding completeness, accuracy, and judgemental aspects of the guidelines are presented along with constructive criticism, wherein defects in the guidelines themselves are identified. Each section was evaluated in terms of environmental impact identification, measurement, interpretation, and communication to information users. The watershed project involves flood prevention measures and expansion of the current land treatment plan. The flood control measures would expend $1.6 million to reduce flood damages on 1,695 acres and increase income on 10 farms, to withdraw 28 acres of cropland from production, and to increase flooding on 84 acres; the land treatment plan is budgeted at $700,000. It was determined that specific data on environmental factors are not always provided. Sheet erosion, wind erosion, annual erosion, and annual sediment are expected to decrease; subsidence reduction and flood damage downstream are predicted, however little substantiation is provided in either case. Impacts on plants and animals and changes in the flood plain are also estimated, based on habitat requirements rather than on census data and flooding behavior analysis. Reduction of flood damages may result in net income benefits to farmers and produce additional employment, but unexplained terminology and lack of documentation cause the socioeconomic analysis and impacts estimates to be questioned. (Wares-IPA)
W78-05814

JAMESPORT TRANSMISSION EXITS; A REVIEW FOR THE TOWN OF RIVERHEAD OF THE LONG ISLAND LIGHTING COMPANY APPLICATION TO THE NEW YORK PUBLIC SERVICE COMMISSION FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED FOR THE JAMESPORT TRANSMISSION EXITS,
Cornell Univ., Ithaca, NY. Center for Environmental Research.
E. Duvernoy, and J. Stanturf.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 695, Price codes: A04 in paper copy, A01 in microfiche. Completion Report, May, 1976. 50 p, 2 fig, 3 tab, 25 ref, 7 append. OWRT A-056-NY(2).

Descriptors: *Transmission lines, Electrical networks, Evaluation, Public utilities, Permits, Environmental effects, Agriculture, *New York, Land use, Economics, Compensation, Routing, Legislation, *Riverhead(NY), Mitigation, Tradeoffs, Environmental impacts, Applications, Environmental compatibility.

A review was made of the document 'PSC Case 26897--Jamesport Transmission Exits' and associated testimony, using the NYCRR 16, Subchapter G, Parts 85, 86, and 88 as principal evaluation criteria. Conclusions presented by the applicant and comments on conclusions are presented for each major topic covered in the application for placement of transmission. Findings indicated that: (1) criteria used to develop the preferred route for the lines did not consider probable environmental consequences on agricultural lands, (2) the approach to assessing visual impacts relied too heavily on judgment rather than on analysis and fact finding, and (3) the proposed facility could adversely affect economic viability of agriculture in Riverhead, New York. The major impacts of the transmission lines will be visual and interfere with land use, but if the transmission facility is justified it will be necessary to consider mitigation techniques or compensation for these impacts to produce a facility acceptable to the utility and to affected communities. The appendices contain information on review chronology, electrical terminology, comments, screening, impacts of an underground alternative, calculations, and the Article VII procedure. (Wares-IPA)
W78-05816

COASTAL WATER RESEARCH PROJECT. ANNUAL REPORT FOR THE YEAR ENDED 30 JUNE 1977.
Southern California Coastal Water Research Project, El Segundo.
For primary bibliographic entry see Field 5B.
W78-05911

ENVIRONMENT, TECHNOLOGY, AND FUTURE GENERATIONS,
Oregon State Univ., Corvallis. Water Resources Research Inst.
For primary bibliographic entry see Field 6B.
W78-05941

RESPONSE OF THE DEVIL'S RIVER (TEXAS) FISH COMMUNITY TO FLOODING,
Baylor Univ., Waco, TX. Dept. of Biology.

For primary bibliographic entry see Field 2I.
W78-05951

ENVIRONMENTAL STATUS OF THE LAKE MICHIGAN REGION, VOLUME 4. PHYTOPLANKTON OF LAKE MICHIGAN,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environment Research Lab.
For primary bibliographic entry see Field 5C.
W78-05973

ENVIRONMENTAL STATUS OF THE LAKE MICHIGAN REGION, VOLUME 6. ZOOBENTHOS OF LAKE MICHIGAN,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
For primary bibliographic entry see Field 5C.
W78-05974

ENVIRONMENTAL STATUS OF THE LAKE MICHIGAN REGION, VOLUME 14. BIRDS OF THE LAKE MICHIGAN DRAINAGE BASIN,
Michigan State Univ., East Lansing.
For primary bibliographic entry see Field 5C.
W78-05975

ENVIRONMENTAL STATUS OF THE LAKE MICHIGAN REGION, VOLUME 16. AMPHIBIANS AND REPTILES OF THE LAKE MICHIGAN DRAINAGE BASIN,
Wisconsin Univ.-Madison. Dept. of Zoology.
For primary bibliographic entry see Field 5C.
W78-05976

NITROGEN - AN ESSENTIAL LIFE FACTOR AND A GROWING ENVIRONMENTAL HAZARD, REPORT FROM NOBEL SYMPOSIUM NO. 38.
For primary bibliographic entry see Field 5B.
W78-05999

SHOULD DAMS BE BUILT. THE VOLTA LAKE EXAMPLE,
United Nations Environment Program, Nairobi (Kenya).
For primary bibliographic entry see Field 5C.
W78-06033

ECOLOGICAL STUDIES IN THE WESTERN SACRAMENTO-SAN JOAQUIN DELTA DURING A DRY YEAR,
California Univ., Davis. Dept. of Water Science and Civil Engineering.
For primary bibliographic entry see Field 2L.
W78-06042

THE ENVIRONMENTAL IMPACT OF FRESHWATER WETLAND ALTERATIONS ON COASTAL ESTUARIES.
Georgia Dept. of Natural Resources, Atlanta. Office of Planning and Research.
For primary bibliographic entry see Field 5C.
W78-06053

CASE STUDY: THE SANTEE RIVER, S.C.,
South Carolina Univ., Columbia.
For primary bibliographic entry see Field 5C.
W78-06055

HYDROLOGIC AND ENVIRONMENTAL EFFECTS OF A LONG-TERM DRAINAGE ON A COASTAL AREA, (CASE STUDY: MELBOURNE TILLMAN DRAINAGE DISTRICT, PALM BAY, FLORIDA),
Florida Inst. of Tech., Melbourne. Center for Coastal Zone Research.
For primary bibliographic entry see Field 2L.
W78-06057

INTEGRATING SCIENTIFIC DATA INTO ENVIRONMENTAL PLANNING AND IMPACT ANALYSIS, GENERAL METHODOLOGY AND A CASE STUDY,
Florida Univ., Gainesville. Dept. of Environmental Engineering Sciences.
W. M. Kemp, and W. R. Boynton.
In: The Environmental Impact of Freshwater Wetland Alterations on Coastal Estuaries, Conference held at Savannah, Georgia on June 23, 1976. p 61-86, 5 fig, 3 tab, 23 ref.

Descriptors: *Planning, *Methodology, *Environmental effects, *Apalachicola River(FL), Analytical techniques, Alternative planning, Model studies, Project planning, Feasibility studies, Cost-benefit analysis, Mathematical models, Army Corps of Engineers, *Florida.

Seven basic steps in environmental evaluation are outlined. These guidelines are pertinent to any environmental evaluation issue, including land use and water management interactions between upstream (freshwater) and downstream (estuarine) ecosystems: (1) conceptualization of models describing a problem; (2) selection of alternative plans to be presented for evaluation; (3) definition of the objective function of a plan in terms of the net energy channeled into work processes in the region, where work includes both work of man and nature; (4) collection and/or measurement of data descriptive of the systems under evaluation; (5) development of mathematical models based on conceptual models; (6) conversion of model outputs and other pertinent data into a common measure unit; (7) selection of the final plan on the basis of comparison of calculated costs and benefits to the objective function for all the plans under consideration. Following the seven outlined steps, the impact of the proposed dam over the Apalachicola River, Florida was evaluated. The conclusion was that the net loss of dam construction would be about 8 billion Kcal FFE per year and therefore the proposed dam would not justify all major costs. (See also W78-06053) (Harris-Wisconsin)
W78-06058

ALTERNATIVE MANAGEMENT STRATEGIES FOR VIRGINIA'S COASTAL WETLANDS: A PROGRAM OF STUDY,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Economics.
W. M. Park, and S. S. Batie.
Sea Grant Program, January, 1978. 14 p, 24 ref.

Descriptors: *Wetlands, *Virginia, *Marsh management, *Project planning, *Economic efficiency, Coastal marshes, Swamps, Marshes, Land reclamation, Planning, Future planning(Projected), Decision making, Water resources development, Conservation, Economic feasibility, Project feasibility, *Alternative planning, *Coastal wetlands(Va).

The planning and procedural processes to be used for a coastal wetland research project, focusing on alternative management strategies, are discussed. The project's objective is to provide a framework within which decision-makers can estimate the tradeoffs between development and presevation. Case studies of coastal wetlands in an urban and a rural recreational county will be part of the project. For each of these counties, the historical use patterns of wetlands, present use patterns, ownership, and exchange values will be identified. Surveys of wetland owners in each study area will be conducted and wetland preservation and development services will be identified to provide framework for decision making. Strategies will be examined in terms of economic efficiency (i.e. maximizing net social values), and in terms of feasibility of implementation. (Steiner-Mass)
W78-06086

DISTRIBUTION, SEASONALITY, AND BIOMASS OF AQUATIC MACROPHYTES IN LAKE OPINICON (EASTERN ONTARIO),
Queen's Univ., Kingston (Ontario). Dept. of Biology.
For primary bibliographic entry see Field 2H.
W78-06088

EFFECTS OF STREAM CHANNELIZATION ON FISH POPULATIONS IN THE BUENA VISTA MARSH, PORTAGE COUNTY, WISCONSIN,
Wisconsin Cooperative Fishery Research Unit, Stevens Point.
For primary bibliographic entry see Field 5C.
W78-06090

AN ECOLOGICAL MODEL FOR LAKE ONTARIO MODEL FORMULATION, CALIBRATION, AND PRELIMINARY EVALUATION,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 2H.
W78-06119

THE EFFECT OF MILITARY TRANSPORTATION ACTIVITIES ON THE ENVIRONMENT,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Mobility and Environmental Systems Lab.
For primary bibliographic entry see Field 4C.
W78-06126

TWO ANOMALIES OF FISH LARVAL TRANSPORT AND THEIR IMPORTANCE IN ENVIRONMENTAL ASSESSMENT,
Power Authority of the State of New York.
For primary bibliographic entry see Field 5C.
W78-06155

7. RESOURCES DATA

7A. Network Design

VERMONT'S WATER RESOURCE RESEARCH NEEDS,
Vermont Univ., Burlington. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W78-05801

7B. Data Acquisition

THE APPLICATION OF REMOTE SENSING TO THE DEVELOPMENT AND FORMULATION OF HYDROLOGIC PLANNING MODELS.
Ecosystems International, Inc., Gambrille, MD.
For primary bibliographic entry see Field 4D.
W78-05718

A STUDY OF APPLICATION OF REMOTE SENSING TO RIVER FORECASTING, VOLUME II.
IBM Federal Systems Div., Huntsville, AL.
For primary bibliographic entry see Field 4A.
W78-05719

REMOTE SENSING OF LAND USE AND WATER QUALITY RELATIONSHIPS-WISCONSIN SHORE, LAKE MICHIGAN,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 5A.
W78-05749

INVESTIGATION OF THE DYNAMICS OF SNOW-COVER MELTING FROM METEOROLOGICAL-SATELLITE DATA,
For primary bibliographic entry see Field 2C.
W78-05788

ESTIMATION OF SNOW-COVER DYNAMICS FOR FORECASTS OF THE SPRING FLOOD IN THE GORNYY ALTAY FROM SATELLITE DATA,
For primary bibliographic entry see Field 2C.
W78-05789

REMOTE DETERMINATION OF THE CONCENTRATION OF SUSPENDED PARTICLES IN THE WATER OF RESERVOIRS ON THE BASIS OF MEASUREMENTS OF SPECTRAL LUMINANCE COEFFICIENTS,
For primary bibliographic entry see Field 2H.
W78-05790

EMISSION CHARACTERISTICS OF MOIST STRATIFIED STRUCTURES IN THE VHF RANGE,
For primary bibliographic entry see Field 2G.
W78-05791

SOME RESULTS OF MEASUREMENTS OF THE RADIO EMISSION OF SOILS USING A HIGHLY SENSITIVE AIRCRAFT RADIOMETER WITH A 3-CM WAVE RANGE,
For primary bibliographic entry see Field 2G.
W78-05792

APPLICATION OF HEAT-FLOW TEMPERATURE MODEL FOR REMOTELY ASSESSING NEAR SURFACE SOIL MOISTURE BY THERMOGRAPHY,
South Dakota State Univ., Brookings. Dept. of Physics.
For primary bibliographic entry see Field 2G.
W78-05932

THE USE OF SATELLITE IMAGERY FOR LAKE CLASSIFICATION IN WISCONSIN,
Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2H.
W78-05935

UTILIZATION OF SATELLITE DATA FOR INVENTORYING PRAIRIE PONDS AND LAKES,
Environmental Research Inst. of Michigan, Ann Arbor.
For primary bibliographic entry see Field 2H.
W78-05979

THE ABC'S OF DIATOM IDENTIFICATION USING LASER HOLOGRAPHY,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 5A.
W78-06035

WETLAND MAPPING IN NEW JERSEY AND NEW YORK,
Earth Satellite Corp., Washington, DC.
For primary bibliographic entry see Field 7C.
W78-06092

SOME REMARKS ON THE USE OF DAILY RAINFALL MODELS,
Agricultural Univ., Wageningen (Netherlands). Dept. of Land and Water Use; and Agricultural Univ., Wageningen (Netherlands). Dept. of Mathematics.
For primary bibliographic entry see Field 2B.
W78-06101

THE INFILTRATION CYLINDER: SOME COMMENTS ON ITS USE,
Dundee Univ. (Scotland). Dept. of Geography.
For primary bibliographic entry see Field 2G.
W78-06103

PACKING AND ANGLE OF REPOSE OF NATURALLY SEDIMENTED FINE SILICA SOLIDS IMMERSED IN NATURAL AQUEOUS ELECTROLYTES,
Imperial Coll. of Science and Technology London (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W78-06106

FACTORS INFLUENCING THE CRUST TEST FOR IN SITU MEASUREMENT OF HYDRAULIC CONDUCTIVITY,
Wisconsin Univ.-Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 2G.
W78-06109

SOLUTE DISTRIBUTION PROFILES COMPUTED WITH STEADY-STATE AND TRANSIENT WATER MOVEMENT MODELS,
New Mexico State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 2G.
W78-06110

STUDY OF NEAR-INFRARED SNOW REFLECTANCE USING SKYLAB S192 MULTISPECTRAL SCANNER DATA,
Environmental Research and Technology, Inc., Concord.
For primary bibliographic entry see Field 2C.
W78-06120

RELATION OF SAMPLE VARIATIONS TOPLATE ORIENTATION IN THE HESTER-DENDY PLATE SAMPLER,
North Dakota State Dept. of Health, Bismarck. Div. of Water Supply and Pollution Control.
J. F. Harrold, Jr.
The Progressive Fish Culturist, Vol. 40, No. 1, p 24-25, 1978. 1 tab, 8 ref.

Descriptors: *Sampling, *On-site data collections, *Aquatic insects, *Aquatic animals, Testing, *Testing procedure, Research equipment, *Invertebrates, *Insects, Research and development, Methodology, On-site investigations, Benthic fauna, *Hester-Dendy Plate Sampler.

This study was undertaken to determine whether variation in the orientation of the rough and smooth sides of the sampler vanes would impose a variation on sample representatives and numbers. It was concluded that a majority of immature aquatic insects display a preference in accordance with the orientation of the rough or smooth sides of the vanes. It was proposed that a standardized vane arrangement be established in order to maximize the collecting capability of the apparatus and to allow inter-experiment data comparison. (Dael-EIS)
W78-06147

USE OF THERMAL-INFRARED IMAGERY IN GROUND-WATER INVESTIGATIONS IN MONTANA,
Geological Survey, Helena, MT. Water Resources Div.; and Kansas Univ., Lawrence. Space Technology Labs.
A. J. Boettcher, and R. M. Haralick.
In: Proceedings of the Eleventh International Symposium on Remote Sensing of Environment, April 25-29, 1977, Michigan University, Ann Arbor: Center for Remote Sensing Information and Analysis Environmental Research Institute of Michigan, p 1161-1170, 1977. 6 fig, 3 ref.

Descriptors: *Remote sensing, *Groundwater, *Inflow, *Surface waters, *Montana, Streams, Lakes, Aerial photography, Thermal properties, Water temperature, Infrared radiation, Methodology, Computers, Columbia River(Mont), *Thermal-infrared imagery, Clark Fork of Columbia River, Kootenai River, Tongue River.

Thermal-infrared imagery was used to locate ground-water inflow along three streams and one lake in Montana. The thermal scanner used in May 1972, March 1973, and November 1975 was mounted in a twin-engined aircraft. On the 1973 and 1975 flights, the data were recorded in an analog format on magnetic tape in flight, later were converted to digital format, and were computer-processed using an assignment of patterns to indicate differences in water temperature. Outputs from the image-processing program was converted to a temperature map having an isotherm spacing of 0.5 degrees C. Computerization was found to be the most efficient method to manipulate data from lakes, large rivers, and narrow sinuous streams. (Woodard-USGS)
W78-06187

COASTAL WETLANDS: THE PRESENT AND FUTURE ROLE OF REMOTE SENSING,
Geological Survey, Reston, VA. Water Resources Div.
V. Carter.
In: Proceedings of the Eleventh International Symposium on Remote Sensing of Environment, April 25-29, 1977, Michigan University, Ann Arbor; Center for Remote Sensing Information and Analysis Environmental Research Institute of Michigan, p 301-303, 1977. 2 fig, 5 tab, 60 ref.

Descriptors: *Wetlands, *Coastal marshes, *Mapping, *Remote sensing, *Aerial photography, Surveys, Classification, Standards, Planning, Satellites(Artificial), Data collections, United States.

During the past decade, there has been a rapid expansion of remote sensing research and technology development related to coastal wetlands. As a result of this research all of the 23 coastal States have ongoing or completed wetland inventories, most utilizing aerial photographs as the data source for producing a variety of map products with varying scales, formats, classification systems, and intended uses. The U.S. Geological Survey is increasing emphasis on map production and revision for the coastal zone. The new U.S. Fish and Wildlife Service National Wetland Inventory is intended to provide a standardized method for comparison of wetlands on a national basis - it too will use available aerial photographs as a basic data source. At present, satellite data is not used for operational mapping of coastal wetlands because of resolution and geometric constraints. In the future, however, satellite data may provide an accurate reliable and economical source to update wetland inventories and to monitor or evaluate coastal wetlands. (Woodard-USGS)
W78-06188

7C. Evaluation, Processing and Publication

THE WELMM APPROACH TO ENERGY STRATEGIES AND OPTIONS,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 6A.
W78-05704

CAPACITY EXPANSION FOR WATER RESOURCE FACILITIES: A CONTROL THEORETIC ALGORITHM FOR NONSTATIONARY UNCERTAIN DEMANDS,
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6D.

W78-05706

REGIONAL WATER SUPPLY PLANNING BY INTERACTIVE SYSTEMS ANALYSIS,
Army Engineer District, Sacramento, CA.
For primary bibliographic entry see Field 4A.
W78-05712

ECONOMIC ANALYSIS OF IRRIGATION PRODUCTION FUNCTIONS: AN APPLICATION OF LINEAR PROGRAMMING,
International Bank for Reconstruction and Development, Washington, DC. Development Research Center.
For primary bibliographic entry see Field 3F.
W78-05714

A STUDY OF APPLICATION OF REMOTE SENSING TO RIVER FORECASTING, VOLUME II.
IBM Federal Systems Div., Huntsville, AL.
For primary bibliographic entry see Field 4A.
W78-05719

THE ANATOMY OF THE MODELLING PROCESS,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W78-05726

RANDOM SEARCH OPTIMIZATION: STOPPING RULES,
Aalborg Universitetscenter (Denmark).
For primary bibliographic entry see Field 2A.
W78-05727

FLOOD PLAIN INFORMATION: MONONGAHELA, WEST FORK AND TYGART RIVERS, MARION COUNTY, WEST VIRGINIA.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 4A.
W78-05761

FLOOD PLAIN INFORMATION: WEST FORK RIVER AND ELK CREEK, CLARKSBURG AND VICINITY, HARRISON COUNTY, WEST VIRGINIA.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 4A.
W78-05762

FLOOD PLAIN INFORMATION: LITTLE WHEELING CREEK, TRIADELPHIA TO VALLEY GROVE, OHIO COUNTY, WEST VIRGINIA.
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 4A.
W78-05763

FLOOD PLAIN INFORMATION: FULTON BRANCH, WEBSTER CREEK AND TRIBUTARIES, WAMAC, ILLINOIS.
Army Engineer District, St. Louis, MO.
For primary bibliographic entry see Field 4A.
W78-05764

FLOOD PLAIN INFORMATION: SILVER CREEK AND TRIBUTARIES, ST. CLAIR COUNTY, ILLINOIS - NO. 1.
Army Engineer District, St. Louis, MO.
For primary bibliographic entry see Field 6F.
W78-05765

SPATIAL INTERPOLATION OF DAILY TOTALS OF RAINFALL,
Royal Netherlands Meteorological Inst., De Bilt.
For primary bibliographic entry see Field 2B.

W78-05766

COMPUTER MODELLING OF GROUNDWATER 13C AND 14C ISOTOPE COMPOSITIONS,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 2F.
W78-05767

A GENERAL CLASS OF STOCHASTIC MODELS FOR HYDROLOGIC SEQUENCES,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 2A.
W78-05768

DEVELOPMENT OF A VERSION OF STANFORD MODEL AND ITS EVALUATION FOR STREAMFLOW SYNTHESIS FROM SMALL WATERSHEDS IN WEST VIRGINIA,
West Virginia Univ., Morgantown. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 2E.
W78-05808

COST OPTIMIZATION OF RURAL WATER SYSTEMS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W78-05810

OPTIMAL STATE ANALYSIS OF RESERVOIRS,
California Univ., Riverside. Dry Lands Research Inst.
For primary bibliographic entry see Field 4A.
W78-05817

ADEQUACY OF HYDROLOGIC DATA FOR APPLICATION IN WEST VIRGINIA,
West Virginia Univ., Morgantown. Water Research Inst.
M. Chang, R. Lee, and W. H. Dickerson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 602, Price codes: A08 in paper copy, A01 in microfiche. Water Research Institute Bulletin 7, (WRI-WVU-76-01), 1976. 145 p, 46 fig, 20 tab, 84 ref, 13 append. West Virginia University Bulletin, Series 78, No 8-3, Feb 1978. OWRT A-023-WVA(3). 14-34-0001-6051.

Descriptors: Evaluation, *Floods, Flow characteristics, *Forecasting, *Hydrologic data, *Isohyets, *Maps, Planning, *Precipitation(Atmospheric), *Streamflow, Water balance, Water management(Applied), *West Virginia, Analysis, Climatology, Evapotranspiration, Hydrology, Low flow, Meterology, Models, Rainfall, Runoff, Snowfall, Storms, Topography, Water resources, Weather.

Surface and atmospheric hydrologic data for West Virginia, and related topographic and climatic information, were assembled and computerized. The data were evaluated, summarized, and reduced to more usable form, and deterministic and stochastic methods were used to develop predictive techniques for describing the spatial and temporal variability of the water resource. The adequacy of the data for assaying, planning, and managing the state's water resources was evaluated in terms of the most frequent or common user needs. The results revealed that the usefulness of raw hydrologic data, and the derived data forms and predictive models, in solving practical water-related problems is inestimable; current inadequacies are related primarily to increasing needs for greater detail and precision. Current and future requirements for more intensive planning and management of the state's water resource will require (1) additional emphasis on data quality, especially in the precipitation network, (2) some broadening of observational networks to include additional rainfall and snow measurements at higher elevations, wind observations in valleys, solar radiation measurements, and streamflow measurements on small streams, and (3) additional research on small watersheds to determine the effects of topography, vegetal cover, and land disturbance on low flows and the water balance.
W78-05931

THE USE OF SATELLITE IMAGERY FOR LAKE CLASSIFICATION IN WISCONSIN,
Wisconsin Univ., Madison. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2H.
W78-05935

USE OF CLIMATIC DATA IN ESTIMATING STORAGE DAYS FOR SOILS TREATMENT SYSTEMS,
Environmental Data Service, Asheville, NC.
For primary bibliographic entry see Field 5E.
W78-05993

WETLAND MAPPING IN NEW JERSEY AND NEW YORK,
Earth Satellite Corp., Washington, DC.
W. W. Brown.
Photogrammetric Engineering and Remote Sensing, Vol 44, No 3, p 303-314, March, 1978. 6 fig, 2 tab, 22 ref.

Descriptors: *Wetlands, *Photogrammetry, *Bioindicators, *Mapping, *New Jersey, *New York, Marshes, Coastal marshes, Tidal marshes, Freshwater marshes, Marsh plants, Aerial photography, Remote sensing, Tidal waters, Distribution patterns, Biogeography, High water mark, Boundaries(Surfaces), Earth-water interfaces, Upper wetland boundary.

Wetlands were mapped using a 1:12,000 scale color infrared aerial photographs. In support of tidal wetlands legislation, the Mean High Water (approximate position) and Upper Wetland Boundary lines were delineated using plant species. In New Jersey, dominant plant species were identified on each map. In New York, a broader classification system was used based on plant species categories such as Coastal Fresh Marsh and High Marsh. In borh New York and New Jersey, an Upper Wetland Boundary Line was delineated. This line represents the landward extent of tidal inundation. In New Jersey, an additional line, the Biological High Water Line, seaward of or coincident with the Upper Wetland Boundary was delineated. This is the approximate high tide line established through use of wetland plant species indicators. (Steiner-Mass)
W78-06092

STUDY OF NEAR-INFRARED SNOW REFLECTANCE USING SKYLAB S192 MULTISPECTRAL SCANNER DATA,
Environmental Research and Technology, Inc., Concord.
For primary bibliographic entry see Field 2C.
W78-06120

STATISTICAL METHODS IN HYDROLOGY,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
C. T. Haan.
The Iowa State University Press, Ames, Iowa. 1977. 378 p. $11.95.

Descriptors: *Hydrology, *Statistical methods, *Publications, *Model studies, Statistics, Correlation analysis, Frequency analysis, Probability, Regression analysis, Time series analysis,

Stochastic processes, Markov processes, Statistical models, Mathematical models, Analytical techniques, Hydrologic systems, Sampling, Data generation, Multivariate analysis, Normal distribution, Spectral analysis, Probability distributions.

The random variability of such hydrologic variables as streamflow and precipitation has been recognized for centuries. The general field of hydrology was one of the first areas of science and engineering to use statistical concepts in an effort to analyze natural phenomena. The purpose of this book was to enable engineers and hydrologists to apply better statistical methods to hydrologic problems through a knowledge of the methods, their foundations, and their limitations. Subject areas covered included: basic concepts of probability and probability distributions, properties of random variables, some discrete probability distributions and their applications, normal distributions, some continuous probability distributions, probability plotting and frequency analysis, confidence intervals and hypothesis testing, simple linear regression, multiple linear regression, correlation, multivariate analysis, data generation, analysis of hydrologic time series, and some stochastic hydrologic models. This is not a statistical 'cookbook' for hydrologists. Basic statistical concepts were discussed and illustrated in enough detail so that one can develop his own computational procedures or models. (Humphreys-ISWS)
W78-06125

RESOURCES ALLOCATION TO OPTIMIZE MINING POLLUTION CONTROL,
Ohio State Univ. Research Foundation, Columbus.
For primary bibliographic entry see Field 5G.
W78-06138

DETERMINATION OF BIOCHEMICAL-OXYGEN-DEMAND PARAMETERS,
Geological Survey, Bay St. Louis, MS. Water Resources Div.; and Geological Survey, Lakewood, CO. Water Resources Div.
For primary bibliographic entry see Field 5A.
W78-06174

WATER RESOURCES DATA FOR OKLAHOMA, WATER YEAR 1975.
Geological Survey, Oklahoma City, OK. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 939, Price codes: A23 in paper copy, A01 in microfiche. Water-Data Report OK-75-1, June 1976. 528 p, 4 fig, 3 tab, 32 ref.

Descriptors: *Oklahoma, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1975 water year for Oklahoma consist of records of stage, discharge, and warer quality of streams; stage, contents, and water quality of lakes or reservoirs. This report contains discharge records for 134 gaging stations; stage and contents for 22 lakes or reservoirs; water quality for 59 gaging stations, 2 partial-record flow stations, and 3 lakes. Also included are 68 crest-stage partial-record stations and 1 low-flow partial-record station. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal Agencies in Oklahoma. (Woodard-USGS)
W78-06175

WATER RESOURCES DATA FOR UTAH, WATER YEAR 1975.
Geological Survey, Salt Lake City, UT. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-259 783, Price codes: A23 in paper copy, A01 in microfiche. Water-Data Report UT-75-1, July 1976. 509 p, 8 fig, 4 tab.

Descriptors: *Utah, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1975 water year for Utah consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoir; and water levels and water quality in wells and springs. This report contains discharge records for 238 gaging stations, stage or contents for 20 lakes and reservoirs, water quality for 41 surface-water stations and 363 wells, and water levels for 159 observation wells. Additional water data were collected at various sites, not part of the systematic data collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Utah. (Woodard-USGS)
W78-06176

WATER RESOURCES DATA FOR MONTANA, WATER YEAR 1976.
Geological Survey, Helena, MT. Water Resources Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 663, Price codes: A99 in paper copy, A01 in microfiche. Water-Data Report MT-76-1, September 1977. 766 p, 10 fig, 4 tab.

Descriptors: *Montana, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1976 water year for Montana consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels in wells. This report contains discharge records for 217 gaging stations, stage only records for 1 lake station, stage and contents for 7 lakes and reservoirs, water quality for 104 stations and 4 lakes, and water levels for 25 observation wells. Also included are 205 crest-stage partial-record stations and 53 smaller reservoirs. Additional water data were collected at various sites, not part of the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Montana. (Woodard-USGS)
W78-06177

SELECTED HYDROLOGIC DATA, PAROWAN VALLEY AND CEDAR CITY VALLEY DRAINAGE BASINS, IRON COUNTY, UTAH,
Geological Survey, Salt Lake City, UT. Water Resources Div.
L. J. Bjorklund, C. T. Sumsion, and G. W. Sandberg.
In cooperation with Utah Dept of Natural Resources, Salt Lake City, Div of Water Rights, Utah Basic-Data Release No 28, 1977. 55 p, 1 fig, 1 plate, 5 tab.

Descriptors: *Groundwater resources, *Well data, *Water levels, *Water quality, *Drillers logs, Water wells, Springs, Aquifer characteristics, Water level fluctuations, Water analysis, Chemical analysis, Sampling, Sites, *Utah, Iron County(Utah), *Parowan drainage basin(Utah), *Cedar City drainage basin(Utah).

This report presents selected basic data from a study of the ground-water resources of the Parowan Valley and Cedar City Valley drainage basins, Iron County, Utah. The study was made during 1973-75 by the U.S. Geological Survey in cooperation with the Utah Department of Natural Resources, Division of Water Rights. The basic data consist of well and spring records, water levels in wells, logs of wells, and chemical analyses of water samples collected from selected wells. A map of Parowan Valley and Cedar City Valley drainage basins shows location of selected wells and springs. A diagram shows well- and spring-numbering system used in Utah. (Woodard-USGS)
W78-06180

COASTAL WETLANDS: THE PRESENT AND FUTURE ROLE OF REMOTE SENSING,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7B.
W78-06188

QUALITY OF RIVERS OF THE UNITED STATES, 1974 WATER YEAR--BASED ON THE NATIONAL STREAM QUALITY ACCOUNTING NETWORK (NASQAN),
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 5A.
W78-06192

WATER RESOURCES OF NO NAME VALLEY, COLVILLE INDIAN RESERVATION, WASHINGTON,
Geological Survey, Tacoma, WA. Water Resources Div.
For primary bibliographic entry see Field 4B.
W78-06194

ESTIMATING PARAMETERS OF COMPACTING FINE-GRAINED INTERBEDS WITHIN A CONFINED AQUIFER SYSTEM BY A ONE-DIMENSIONAL SIMULATION OF FIELD OBSERVATIONS,
Geological Survey, Sacramento, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W78-06196

A TWO DIMENSIONAL LAKE CIRCULATION MODEL USING THE METHODS OF FINITE ELEMENTS,
Massachusetts Univ., Amherst. Water Resources Research Center.
For primary bibliographic entry see Field 2H.
W78-06200

8. ENGINEERING WORKS

8A. Structures

A LABORATORY STUDY OF THE STABILITY OF SAND-FILLED NYLON BAG BREAKWATER STRUCTURES,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 8G.
W78-06121

8B. Hydraulics

DESIGN OF LARGE URBAN SEWER SYSTEMS WITH A WATER-FLOW SIMULATION PROGRAM,
Balzari Blaser Schudel, Bern (Switzerland).
For primary bibliographic entry see Field 5D.
W78-05722

OPTIMIZATION METHODS FOR PLANNING WASTE WATER MANAGEMENT SYSTEMS,
Karlsruhe Univ. (West Germany). Inst. fuer Siedlungswasserwirtschaft.
For primary bibliographic entry see Field 5G.
W78-05723

INTERACTION OF TSUNAMIS WITH THE HAWAIIAN ISLANDS CALCULATED BY A FINITE-ELEMENT NUMERICAL MODEL,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 2L.
W78-05772

DILUTION GAUGING ON THE RECESSION LIMB: 1. CONSTANT RATE INJECTION METHOD,
Institute of Hydrology, Wallingford (England).
K. Gilman.
Hydrological Sciences Bulletin, Vol 22, No 3, p 353-369, September 1977. 2 fig, 2 tab, 27 ref.

Descriptors: *Tracers, *Streams, *Dispersion, *Mixing, Model studies, Mathematical models, Streamflow, Flow, Gaging, Dye dispersion, Dye releases, Fluorescent dye, Hydrographs, Hydraulics, *Dilution gaging, Dilution, Injection methods.

The application of dilution gauging techniques to rivers and streams and other variable flows incurs a systematic error caused by the change in discharge with time. The discharge calculated from dilution gauging results may be considered as an estimate of the stream discharge at the injection section or the sampling section, and the magnitude and sense of the error vary according to this choice. On the recession limb of a hydrograph and in other cases where the discharge may be expected to change smoothly and gradually, the equations derived from a residence time model previously proposed may be linearized, and formulas of general applicability maybe developed. In this paper formulas were presented for the error arising in the case of a constant rate tracer injection, and examples were given of their application to results from a number of different flow systems. It was shown that the error may be significant in two situations: where the rate of change of discharge is high, and where poor mixing necessitates long gauging reaches and hence long tracer injections. (Sims-ISWS)
W78-05774

QUADRANT-PLATE WEIR,
Concordia Univ., Montreal (Canada), Dept. of Civil Engineering.
A. S. Ramamurthy, K. Subramanya, and B. S. Pani.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol 103, No HY12, Proceedings Paper 13395, p 1431-1441, December 1977. 9 fig, 3 tab, 8 ref, 2 append.

Descriptors: *Weirs, *Discharge(Water), *Flowmeters, *Rating curves, Theoretical analysis, Measurement, Flow, Hydraulics, Laboratory tests, Equations, Data collections, Discharge coefficient, *Proportional weirs, Quadrant plate weirs, Sharp crested weirs, Linear proportional weirs.

The simple weir flow equation was integrated numerically for a quadrant plate weir to show that the head-discharge relationship for this weir is approximately lenear. Theoretically, deviations from linearity (H vs Q) can be limited to 0.5% by a judicious choice of the parameters that determine the weir geometry. The results of experiments on selected weirs were in agreement with the predicted relationships. The coefficient of discharge for the quadrant-plate weir is a function of the approach channel Froude number. For very low Froude numbers (F less than 0.1), the coefficient of discharge asymptotically approaches a value of 0.61. (Humphreys-ISWS)
W78-05784

DEPENDENCE OF THE CORIOLIS AND BOUSSINESQ COEFFICIENTS ON THE SLOPE OF A MOUNTAIN STREAM,
For primary bibliographic entry see Field 2E.
W78-05797

CHARACTERISTICS OF SOME REGULARIZING PROCEDURES FOR DETERMINING THE MORPHOMETRIC CHARACTERISTICS OF A RIVER CHANNEL,
For primary bibliographic entry see Field 2E.
W78-05798

COST OPTIMIZATION OF RURAL WATER SYSTEMS,
Iowa State Univ., Ames. Dept. of Civil Engineering.
R. B. Robinson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 619, Price codes: A06 in paper copy, A01 in microfiche. Master of Science Thesis, 1975. 94 p, 28 fig, 7 tab, 29 ref. OWRT A-048-IA(3).

Descriptors: *Optimization, *Rural areas, *Water distribution(Applied), *Distribution systems, Pipes, Dynamic programming, Linear programming, Computer programs, Looped distribution systems, Unlooped distribution system, Dead end system, Rural water systems.

A method was developed and demonstrated for optimizing a rural water distribution system in Iowa. The method described achieves the least cost design or the optimal design for certain portions of such a system, which is generally and uniquely unlooped or dead end; linear programming and engineering judgement are the combined techniques utilized. The variables which can be considered by this approach are: the pipe diameter, pipe pressure rating, pressure reducing valve setting and location, and pumping head or water tower height. These variables are considered for a minimum pressure to be met throughout the system and for several maximum pressures for pipe classes and service lines. The solution obtainable by the procedure is considered closer than that produced by conventional design techniques. The method was demonstrated successfully on a simple distribution system. Recommendations are made for refinement of the optimization method, development of a computer program for distribution, and eventual application of linear programming to looped distribution systems. (Wares-IPA)
W78-05810

DESIGN OF AN OUTFALL,
Montgomery (James M.), Inc., Pasadena, CA.
F. A. Grant, J. L. Chao, and P. V. Hennessy.
Journal Water Pollution Control Federation, Vol 50, No. 2, p 347-361, February, 1978. 10 fig, 3 tab, 18 ref.

Descriptors: *Outfall sewers, *Ocean waves, *Surf, *Corrosion control, *Construction materials, Anodes, Structural design, Steel, Construction joints, Diffusion, Pulp wastes, Ocean currents, Zinc, Waste water disposal, Municipal wastes.

An ocean outfall was designed for the cities near Humboldt Bay, California, with specific attention to wave forces, ocean bottom velocities, ocean floor sediment composition and topography, seasonal irregularities, and outfall construction materials. The pipeline design was a compromise between a fully articulated pipe with ball joints and a totally static buried or pile-supported pipe. The pipeline was constructed of flexible, coated steel and supported by sheet piling within the first 2,000 ft from shore with ball joints joining the sheet piling to the diffuser. The diffuser, maintained above the ocean floor in a wave breaking zone, was anchored with ballast rock ranging 1.5-2.0 ft in diameter. Protection against cathodic corrosion was provided by a sacrificial zine anode system. The outfall, which was located between two pulp mill outfalls discharging log-bearing debris, was protected from physical damage by minimum burial. The final outfall pipe design included five ball joints at 200-ft intervals, two joints near the trunkline rock foundation, and a diffuser wall thickness of 1.5 inches to resist corrosion. The outfall was designed to last at least 50 years. (Lisk-FIRL)
W78-05828

FLOW ATTENUATION IN SEWERS,
University of the Witwatersrand, Johannesburg (South Africa). Dept. of Hydraulic Engineering.
D. Stephenson.
Public Health Engineer, Vol. 5, No. 6, p 157-159, 1977. 1 fig, 8 ref.

Descriptors: *Hydraulic models, *Attenuation, *Conduits, *Channel flow, *Storm water, Hydraulic engineering, Mathematical models, Graphical analysis, Chezy equation, Darcy-Weisbach equation, Mannings equation, Waste water disposal, Municipal wastes.

A mathematical model was developed for the cost-effective estimation of flow attenuation in storm water and sewage drains and for the calculation of water quality and velocity required to flush these drains. Flow attenuation studies are often designed for steady state conditions. Steady state friction equations developed by Mannings, Chezy, and Darcy were employed. Short duration inflow waves were found to decrease in depth, elongation and flattening as they move down the conduit. Velocities, inflow rate, duration, conduit length, bed slope, diameter, friction fator, and base flow are considered as variables in the equations. A graph depicting the attenuation in depth of the surge was developed for calculating minimum drain diameters for storm routeing, end capacities after routeing, and the flow required to scour deposits accumulated on the interior sewer walls. Flow rates in conduits were maximized by the addition of storm water inflows along the length of the pipe. (Lisk-FIRL)
W78-05830

SEEPAGE FROM A TRAPEZOIDAL AND A RECTANGULAR CHANNEL USING VARIATIONAL INEQUALITIES,
California Univ., Santa Barbara. Dept. of Mechanical and Environmental Engineering.
For primary bibliographic entry see Field 4B.
W78-06098

BED CONDUCTION COMPUTATION FOR THERMAL MODELS,
Geological Survey, Bay St. Louis, MS. Water Resources Div.
H. E. Jobson.
Journal of the Hydraulics Division, Proceedings of ASCE, Vol 103, No HY10, Paper 13251, p 1213-1217, October 1977. 11 ref.

Descriptors: *Computer models, *Heat transfer, *Water temperature, *Channels, *Thermal conductivity, Heat budget, Thermal pollution, Analytical techniques, California, Thermal modeling.

The conduction of energy between water and the channel bed is shown to be an important consideration in predicting instantaneous temperatures in water bodies as deep as 3 meters. Assessment is based on 141 days of data collected on a canal in southern California. By considering the bed to be a homogeneous flat plate, insulated on the bottom and with an instantaneous surface temperature on the top equal to that of the overlying water, a model is derived which accounts for bed conduction. The rate of change of heat content of the plate, which must equal the heat flux between the water and bed, is determined from the heat-storage capacity and thermal diffusivity of 0.01 sq cm/s was found to apply to this concrete-lined canal. A convolution interval of 24 hours was sufficient to represent the water temperature of the systems. (Woodard-USGS)
W78-06185

8C. Hydraulic Machinery

JAMESPORT TRANSMISSION EXITS; A REVIEW FOR THE TOWN OF RIVERHEAD OF THE LONG ISLAND LIGHTING COMPANY APPLICATION TO THE NEW YORK PUBLIC SERVICE COMMISSION FOR A CERTIFICATE OF ENVIRONMENTAL COMPATIBILITY AND PUBLIC NEED FOR THE JAMESPORT TRANSMISSION EXITS,
Cornell Univ., Ithaca, NY. Center for Environmental Research.
For primary bibliographic entry see Field 6G.
W78-05816

OPTIMAL STATE ANALYSIS OF RESERVOIRS,
California Univ., Riverside. Dry Lands Research Inst.
For primary bibliographic entry see Field 4A.
W78-05817

USE OF MIXING PIPES TO IMPROVE THE FLOW OF WASTE WATER INTO LAKES (EINSATZ VON MISCHROHREN ZUR VERBESSERUNG DER EINLEITUNG VON ABWASSER IN SEEN),
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
For primary bibliographic entry see Field 5E.
W78-05829

MOBILE DIESELS STAND-BY AT SEWAGE PUMPING STATIONS.
Progress Engineering, p 13, September, 1977.

Descriptors: *Generators, *Motor generators, *Pumping plants, *Electric power, *Floods, Hydraulics, Treatment facilities, Waste water treatment, Sewage disposal, Overflow.

The use of stationary automatic and mobile generators, manufactured by Auto Diesels Braby of England, is suggested for the prevention of waste water flooding in pumping stations or treatment plants during electrical power failures. Automatic generators are recommended for unmanned or remote pumping stations where there is an immediate danger of flooding in the event of a power loss. The standby power of these automatic diesels can be supplied within 20 seconds of an electrical failure. The diesels can also be programmed for manual start in manned operations. The generator, which is hooked into the main controls, can supply the initial high voltage necessary to restart the pumping equipment. Mobile generators are practical for remote or regional facilities where electrical power failure does not pose an immediate threat of flooding. Since the system is mobile, with its own control panel and fuel tank equipped trailer, it can be transported to the site of the power failure and connected to the main controls. The mobile generator may also be used as a standby power source for other activities when not in service at a pumping station. (Lisk-FIRL)
W78-05855

TRENDS EMERGE, BUT SOLAR DESIGN OPTIONS STILL OPEN,
Modern Metals, Chicago, IL.
J. A. Mungovan.
Modern Metals, Vol. 33, No. 10, p 22-24, 26, November, 1977. 3 fig.

Descriptors: *Solar radiation, *Energy, *Treatment facilities, *Sewage treatment, Equipment, Design, Methane, Electric power costs, Fuels, Maine, Government finance, Municipal wastes, Waste water treatment.

A new plant for waste water treatment in Wilton, Maine, will obtain most of its energy requirements from solar collectors located on the southern exposure of the plant and from methane generated by the treatment processes. Due to federal and state participation, payback to Wilton will be about two yrs; the plant would require about 18 yrs to pay for itself without aid. The $2 million plant will use 54-double-glazed, copper-and-aluminum flat plate collectors supplied by Grumman Energy Systems. The energy demand of the equipment is low and the plant is designed so as to minimize heat loss. Fuel cost savings are expected to amount to $3594 annually; electricity cost savings should be $875 each year. This application of solar energy won the Owens-Croning Fiberglass Corporation Energy Conservation Award for 1975. Grumman Energy System's aluminum flat plate collector can be used interchangeably with its copper-and-aluminum flat plate collector in some applications. (Snyder-FIRL)
W78-05861

CONVERTING WASTES TO ENERGY--A CONCEPTUAL APPROACH,
Nihon Suido Consultants Co. Ltd., Tokyo.
For primary bibliographic entry see Field 5D.
W78-05896

PHOTOSYNTHESIS AND SOLAR ENERGY CONVERSION,
Cornell Univ., Ithaca, NY. Div. of Biological Sciences.
R. K. Clayton.
Available from the National Technical Information Service, Springfield, VA 22161 as BNL 50530, Price codes: A17 in paper copy, A01 in microfiche. In: Chlorophyll-Proteins, Reaction Centers, and Photosynthetic Membranes, Rep No. 28. Rep BNL 50530, Mar 1977. p 1-15, 2 fig, 1 tab, 36 ref. Edited by J. M. Olson and G. Hind. ERDA EY-76-C-02-0016.

Descriptors: *Photosynthesis, *Solar energy, *Fuels, *Energy conversion, Nuclear energy, Heat, Thermal power, Wind-powered turbines, Solar heating, Oceans, Algae, Solar radiation, Plant tissues, Fossil fuels, Hydrogen, Silicon photovoltaic cells.

A study of potential uses of photosynthesis for energy production is included in the proceedings of the Brookhaven National Laboratory Symposium, 'Chlorophyll-Proteins, Reaction Centers, and Photosynthetic Membranes.' Energy sources stemming directly or indirectly from solar origin which might become important in the United States include: (1) wind-powered turbines; (2) ocean thermal gradients (heat engines); (3) direct solar heating (heat engines or chemical reaction cycle producing hydrogen from water); (4) photosynthetic systems (growth of plants, including algae, and conversion to fuels, or photosynthetic hydrogen production); and (5) photoelectric devices, possible using materials derived from photosynthetic tissues. Sunlight offers our best long-term hope for an inexhaustible source of pollution-free energy, and the most practical schemes utilize direct heating and wind power. Costs of silicon photovoltaic cells must be reduced if such cells are to be competitive. Conversion of organic waste and plants into fuel is practical, but demands exceed supply. Use of photosynthetic tissues in special ways appears highly visionary, but worthy of investigation. U.S. energy reserves are estimated as follows: current oil and gas, < 10 years; total oil and gas, 100 years; fission, < 100 years; coal and oil shale, > 1000 years; geothermal, > 100 years; fusion, one million-one trillion years; and solar, > one trillion years. (Lynch-Wisconsin)
W78-05969

TURBINE ASPIRATION FOR OXYGEN SUPPLEMENTATION,
Alabama Univ., University. Dept. of Engineering Mechanics.
For primary bibliographic entry see Field 5G.
W78-06017

OFF-PEAK HOUR PUMPING RATE REDUCTION: ARE THE BENEFITS WORTH THE COSTS,
Boyle Engineering Corporation, Ventura, CA.
For primary bibliographic entry see Field 6B.
W78-06134

8D. Soil Mechanics

A STOCHASTIC MODEL OF LEVEE FAILURE,
Eotvos Lorand Univ., Budapest (Hungary). Dept. of Numerical Methods.
F. Szidarovszky, L. Duckstein, and I. Bogardi.
In: Mathematical Models for Environmental Problems. Proceedings of the International Conference, University of Southampton, England, Sept. 8-12, 1975. C.A. Brebbia (Ed.), Southampton University. John Wiley & Sons, N.Y., N.Y., p 129-140, 1976. 1 fig, 1 tab, 13 ref.

Descriptors: *Stochastic processes, *Levee failure, *Flood control, *Probability, Flat land, Hungary, Flood damage, Design, River basins, Equations, Mathematical models, Reach(Streams), Systems analysis.

In flood control development, available funds must be used to provide the greatest benefit to the protected area. The optimal development may be determined in four steps: (1) establish the present degree of protection of the flood control system; (2) consider development alternatives; (3) estimate the optimal development in a reach; and (4) calculate the optimal program of development of the flood control system. Herein, a method is described for the present degree of protection. The approach is applicable primarily to flat-land type rivers, where the most successful method of flood control is still the levee. In Hungary, the only effective method for decreasing flood damages is the construction, strengthening, and maintenance of flood levees. Considered first is the probability of failure in a given cross-section and then in a river reach. The method deals with (1) the stochastic character of flood load, (2) the various degrees of protection offered along the levee reach, and (3) the different modes of failure. For each failure mode, the levee reach is divided into subreaches, within which the mean value and variance of resistance for each failure model is constant. The equation for this can be solved in four different cases depending on the various uncertainties involved, and a practical example is presented to illustrate the difference between these four cases. It is shown that reliability of levee systems can be estimated by considering uncertainties in the load and resistances, as well as parameter uncertainty due to small sample size of loads. (See also W78-05720) (Bell-Cornell)
W78-05724

GROUND PROBLEMS OVERCOME ON CRAWLEY SEWER JOB.
Surveyor, Vol. 150, No. 4452, p 15, October, 1977.

Descriptors: *Sewers, *Excavations, *Construction materials, *Soil engineering, *Soil erosion, Design data, Equipment, Soil dynamics, Earth handling equipment, Seepage control.

A support system for excavation site walls has been developed by Shorco Trench Systems Ltd of Leeds, England. The Escon box system has been used in sewer construction projects where the ground is unstable or saturated and where the soil lacks cohesion. The Escon box consists of steel side supports connected with braces and shock absorbing equipment. The modular assembly has sharp bottom edges for ease of installation. The supports are 3.4-m long by 2.6-m high and the system has an expandable width from 0.9-4.5 m. The support system prevents erosion of the trench walls where seepage pressures or soil properties cause unstable conditions. Additional supports can be added to the shoring system in 1.3-m sections where excavation depth exceed the height of the support walls. The system has been used for a sewer installation project in Crawley, England. (Lisk-FIRL)
W78-05824

LIQUEFACTION POTENTIAL OF DAMS AND FOUNDATIONS, REPORT 1. LABORATORY STANDARD PENETRATION TESTS ON REID BEDFORD MODEL AND OTTAWA SANDS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Soils and Pavements Lab.
W. A. Bieganousky, and W. F. Marcuson, III.
Available from the National Technical Information Service, Springfield, VA 22161 as ADA-033 337, Price codes: A08 in paper copy, A01 in microfiche. Research Report S-76-2, October 1976. 156 p, 41 fig, 13 tab, 2 append.

Descriptors: Dams, *Dam foundations, *Failures, *Laboratory tests, *Penetration, *Sands, Bulk density, Soil tests, Curves, Overburden, Soil pressure, Statistical methods, Correlation analysis, Uniformity coefficient, Testing, Equipment, Consolidation, Sieve analysis, Submergence, *Liquefaction, *Standard penetration tests, Relative density, In situ tests, Ottawa sand.

The Standard Penetration Test (SPT) was examined critically with respect to its ability to estimate relative density in situ. A review of the literature tracing the development of the SPT was presented. Using Reid Bedford Model sand and Ottawa sand, 26 test specimens, 4 ft in diameter by 6 ft high, were constructed. A variety of placement techniques were incorporated in the test program. The problems encountered in constructing large homogeneous test specimens were discussed. Using field drilling equipment, the SPT was performed at 3 overburden pressures on test specimens built to various densities. The results were presented as a family of curves correlating relative density with the SPT N-values at the testing pressures. This correlation was compared with correlations prepared by Gibbs and Holtz at the Bureau of Reclamation and Bazaraa at the University of Illinois. It was concluded that the SPT is repeatable in homogeneous deposits; however, variations in density, structure, or lateral stress within the test medium will produce widely scattered N-values. Thus, estimates of in situ relative densities from N-values should be considered gross values or trends and should not be interpreted as accurate determinations for any specific case. (Visocky-ISWS)
W78-06124

8G. Materials

QUADRANT-PLATE WEIR,
Concordia Univ., Montreal (Canada). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W78-05784

PROTECTION OF UNDERGROUND WATER MAINS AGAINST CORROSION,
Bombay Municipal Corp., Bombay (India).
V. M. Shidhaye.
Journal of the Institution of Engineers (India), Vol. 57, Part CH 3, p 127-133, June, 1977. 4 tab, 6 ref.

Descriptors: *Construction materials, *Corrosion, *Pipelines, *Sewers, *Linings, Pipes, Conveyance structures, Soil properties, Waste water treatment.

Various aspects of the protection of underground pipelines against corrosion are discussed. The collection of preliminary data on soil properties, the behavior of existing pipelines, and soil resistivity is recommended before large diameter pipelines are emplaced. Various coating materials have been used to segregate the pipe surface from corrosive soils or water. The chemical resistance, resistance to water absorption, electrical resistance, mechanical strength, ease of application, durability, and curing time are compared for various coating materials, including: gunite, coal tar enamel, fiberglass wrap, blown asphale, plastic tape, and impregnated hessian. Coal tar coatings are recommended for areas characterized by a high water table or saturated soil conditions. Polyethylene sleeving is recommended for use in aggressive soils. (Baker-FIRL)
W78-05826

DESIGN OF AN OUTFALL,
Montgomery (James M.), Inc., Pasadena, CA.
For primary bibliographic entry see Field 8B.
W78-05828

A PUMP TEST IN THE DAKOTA SANDSTONE AT WALL, SOUTH DAKOTA,
South Dakota School of Mines and Technology, Rapid City. Dept. of Geology and Geological Engineering.
For primary bibliographic entry see Field 4B.
W78-05946

A LABORATORY STUDY OF THE STABILITY OF SAND-FILLED NYLON BAG BREAKWATER STRUCTURES,
Coastal Engineering Research Center, Fort Belvoir, VA.
R. Ray.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A039 265, Price codes: A05 in paper copy, A01 in microfiche. Miscellaneous Report No. 77-4, March 1977. 75 p, 56 fig, 5 tab, 9 ref, 1 append.

Descriptors: *Breakwaters, *Waves(Water), *Ocean waves, Laboratory tests, Shores, Coasts, Beaches, Structures, Coastal structures, Coastal engineering, Materials, Materials testing, *Sand bags, Sandbag breakwaters, Sandbag materials, Nylon sandbags, Wave tank tests.

One emergent and three submerged breakwaters built of sand-filled nylong bags on a sand bed were subjected to progressively more severe wave conditions in full-scale laboratory tests. The tests determined the properties of the bags, the effects of wave action on placement of bags, and the performance of bags and structures for various combinations of structure configuration and wave conditions. The changes in the sand bed at the base of the structures and the wave attenuation by the breakwaters also were investigated. The uncoated nylon material deteriorated after 1-year exposure to sunlight and was torn by handling equipment during breakwater water construction. Wet material was slippery and trapped air. When filled with sand, the smooth, rounded bags, sometimes cushioned by an air bubble, failed to interlock adequately to prevent motion under the least severe wave condition. Bags were dropped accurately into place during wave action to construct one of the submerged breakwaters. During testing, the structures' configurations changed drastically, primarily from movement of bags during the first wave attack of the least severe wave condition and during the steepest wave condition. The two highest submerged breakwaters lost whole layers of bags from their crests, and the seaward face of the emergent breakwater slumped from a slope of 1 on 3 to a slope of 1 on 5.3. As wave conditions changed, scour and accretin occurred alternately at the breakwaters' toes but caused no measureable settlement. The emergent breakwater and the highest submerged breakwater, the two producing greater than 30% wave attenuation, underwent the most wave-induced damage. (Sims-ISWS)
W78-06121

LIQUEFACTION POTENTIAL OF DAMS AND FOUNDATIONS, REPORT 1. LABORATORY STANDARD PENETRATION TESTS ON REID BEDFORD MODEL AND OTTAWA SANDS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Soils and Pavements Lab.
For primary bibliographic entry see Field 8D.
W78-06124

8I. Fisheries Engineering

IDENTIFICATION OF LARVAL FISHES TAKEN FROM THE INSHORE WATERS OF SOUTHEASTERN LAKE MICHIGAN NEAR THE DONALD C. COOK NUCLEAR PLANT, 1973-1975,
Michigan Univ., Ann Arbor. Great Lakes Research Div.
For primary bibliographic entry see Field 2H.
W78-05758

DETERMINATION OF PHYSICAL AND HYDRAULIC PREFERENCES OF BROWN AND BROOK TROUT IN THE SELECTION OF SPAWNING LOCATIONS,
Wyoming Univ., Laramie. Dept. of Agricultural Engineering.
D. W. Reiser.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 558, Price codes: A06 in paper copy, A01 in microfiche. Master of Science Thesis, May, 1976. 112 p, 29 fig, 12 tab, 111 ref, 3 append. OWRT C-7002 (620)(1).

Descriptors: *Spawning, *Brook trout, *Brown trout, *Trout, Behavior, *Wyoming, *Salmonids, Depth, Velocity, Stream gage, Streamflow, Incubation, Spawning criteria, Spawning behavior, Egg planting, *Spawning establishment, Instream flow, Stream resource maintenance flow, Incubation flow, Substrates, Cover proximity.

Spawning criteria for 56 brook and 121 brown trout redds in 7 stream sections of southeastern Wyoming were developed using the parameters of depth, velocity, and substrate size. Egg planting experiments were conducted to determine the combinations of parameters which afford the highest percent survival of brown trout eggs. The physical and hydraulic characteristics of spawning locations and the influence on spawning exerted by the proximity of cover were analyzed. Measurements of depth, mean velocity, and point velocity, were taken at the upper edge, pit and tailspill of each redd. A representative substrate sample was collected from the tailspill and later analyzed using a series of 9 seives. Permeability of the substrate was measured at the redd site using a Mark IV standpipe. The developed criteria are applicable for brook trout up to 12 in. and brown trout up to 16 in. Brook and brown trout exhibit preferences for depths, velocities, and substrate types when selecting spawning areas; brown trout appear to use velocity more than depth in the

selection process. No definitive relationship was determined between the location of spawning areas and the distance from cover. The egg planting experiment failed to generate any substantial data concerning suitable spawning areas. Procedural changes and further study in the effects of superimposition of redds, stream sedimentation, and egg predation are recommended. (Seip-IPA)
W78-05802

TWO ANOMALIES OF FISH LARVAL TRANSPORT AND THEIR IMPORTANCE IN ENVIRONMENTAL ASSESSMENT,
Power Authority of the State of New York.
For primary bibliographic entry see Field 5C.
W78-06155

9. MANPOWER, GRANTS AND FACILITIES

9A. Education (Extramural)

CALIFORNIA WATER RESOURCES CENTER ANNUAL REPORT, JULY 1, 1976-SEPTEMBER 30, 1977.
California Univ., Davis. Water Resources Center.
For primary bibliographic entry see Field 9D.
W78-06040

DIRECTORY OF WATER RESOURCES EXPERTISE, WATER RESEARCH FACULTY AND STAFF SCIENTISTS.
California Univ., Davis. Water Resources Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 688, Price codes: A05 in paper copy, A01 in microfiche. Revised Edition, December 1977. 86 p.

Descriptors: *Scientific personnel, *Professional personnel, *Research and Development, Comprehensive planning, Project planning, Water Resources Institute, Education, Universities, Colleges, Training, *Directories, *California.

This publication was compiled to fill a need for the identification of persons working in water resources research on the several campuses of the University for the benefit of those with the University of California as well as individuals, governmental agency personnel, and business and industrial personnel. The primary purpose is to facilitate contact between those desiring information in a specific area and those able to provide such information. (See also W75-11580) (Snyder-Calif, Davis)
W78-06041

9D. Grants, Contracts, and Research Act Allotments

CALIFORNIA WATER RESOURCES CENTER ANNUAL REPORT, JULY 1, 1976-SEPTEMBER 30, 1977.
California Univ., Davis. Water Resources Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-279 614, Price codes: A06 in paper copy, A01 in microfiche. Report No. 42, December 1977, 96 p.

The principal investigators of fresh water projects sponsored by the Water Resources Center have submitted their annual reports, from which the most essential information has been abstracted to form this narrative section. The individual narratives have been purposely kept brief. Each emphasized, whereever pollsible, the 'hard' results and the actual or potential applications of those results to benefit affected interests. Shown also are starting and scheduled ending dates for each research project. The reader may infer from these the relative degree of progress achieved to data, together with an indicaton of when further information might become available--usually at least six months after completion of the project for any detailed account. The report covers both State of California and Federally funded research activities. (Snyder-Calif, Davis)
W78-06040

DIRECTORY OF WATER RESOURCES EXPERTISE, WATER RESEARCH FACULTY AND STAFF SCIENTISTS.
California Univ., Davis. Water Resources Center.
For primary bibliographic entry see Field 9A.
W78-06041

10. SCIENTIFIC AND TECHNICAL INFORMATION

10B. Reference and Retrieval

GREAT LAKES FISH EGG AND LARVAE IDENTIFICATION: PROCEEDINGS OF A WORKSHOP, APRIL 19-21, 1976, ANN ARBOR, MICHIGAN.
National Power Plant Team, Ann Arbor, MI.
For primary bibliographic entry see Field 2H.
W78-05753

10C. Secondary Publication And Distribution

GREAT LAKES FISH EGG AND LARVAE IDENTIFICATION: PROCEEDINGS OF A WORKSHOP, APRIL 19-21, 1976, ANN ARBOR, MICHIGAN.
National Power Plant Team, Ann Arbor, MI.
For primary bibliographic entry see Field 2H.
W78-05753

CURRENT LEVEL OF TAXONOMIC INFORMATION ON GREAT LAKES FISH EGGS AND LARVAE,
State Univ. of New York at Syracuse. Dept. of Forest Zoology.
For primary bibliographic entry see Field 2H.
W78-05754

FISH INHABITING U.S. WATERS OF THE GREAT LAKES, WITH INDICATIONS OF THEIR RELATIVE ABUNDANCE AND OF THEIR IMPORTANCE AS COMMERCIAL, SPORT, OR FORAGE SPECIES,
National Marine Fisheries Service, Ann Arbor, MI. Great Lakes Fishery Lab.
For primary bibliographic entry see Field 2H.
W78-05755

FISH EGG AND LARVAE STUDIES: SOME PROBLEMS AND RECOMMENDED SOLUTIONS,
Maryland Univ., Solomons. Chesapeake Biological Lab.
For primary bibliographic entry see Field 02H.
W78-05756

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A. CENTERS OF COMPETENCE		
Colorado State University, Irrigation Return Flow Quality	W78-06097	1
Cornell University, Policy Models for Water Resources Systems	W78-05701--05707 05710 05712--05727 05942	25
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C. OTHER	
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SOURCE	ACCESSION NUMBER	TOTAL
C. OTHER (CONTINUED)		
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